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Official statistics and role of the chestnut from unification of Italy to nowadays

Adua Mario

Abstract The agricultural investigation of the italian Parliament, published in 1884, also highlighted, especially in reports on individual territorial districts, the importance of chestnut in the italian mountains. Since the early twentieth century are available long time series collected by ISTAT (National Statistics Institute) data on surface and production of the chestnut and foreign trade of the chestnuts.

Key words: Role of the chestnut, statistics, multifunctionality, agricultural policy

1 Official statistics and role of the chestnut

The chestnut (Castanea sativa Miller) is the breadfruit and the tree of life that precedes and then accompanies the first man in history. Since Roman times, and even more in the Middle Ages and in Modern times, Italy is the european territory in which the chestnut spreads further contributing increasingly to the survival of the mountaineer.

In the second half of the nineteenth century, the widespread presence of chestnut still identifies two particular social and economic situations: "The international poverty and the chestnut" portrays the role of the chestnuts in human nutrition in large parts of the Alps and the Apennines and "The civilization of the chestnut" photographs with a still of the customs, traditions, use of timber, fruit and use rules that govern the lives of many mountaineers from Piemonte to Veneto, from Lombardia to Calabria [1].

The agricultural investigation of the italian Parliament, published in 1884-1886, also highlighted, especially in reports on individual territorial districts, the importance of chestnut in the italian mountains [2].

Since the early twentieth century are available long time series collected by Ministry of Finance [3] and ISTAT (National Statistics Institute) [4, 5, 6] data on surface and production of the chestnut and foreign trade of the chestnuts.

The examination of the many available statistical data to divide the evolution of italian chestnut by the unit to date in four historical periods.

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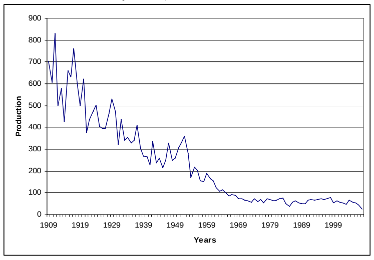
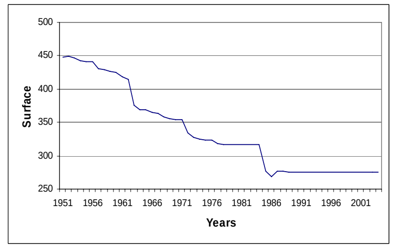
Figure 1: Chestnut production *(production on thousands of tons)*. Years 1909 – 2008



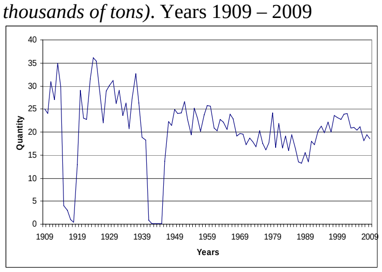
Source: Istat, Forestry statistics – Years 1909-2008

Figure 2: The fruitbearing chestnut area *(surface on thousands of hectares)* – Year 1951 – 2004



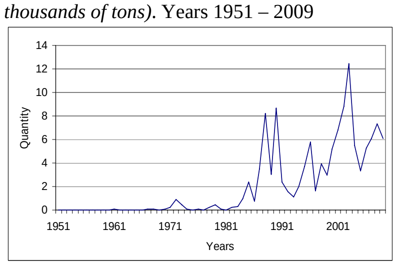
Source: Istat, Forestry statistics – Years 1951-2004

Figure 3: Export of chestnuts *(quantity on thousands of tons)*. Years 1909 – 2009



Source: Ministry of Finance, Commercial movement – Years 1909-2008
- Istat, Foreign trade - Years 1934-2009

Figure 4: Import of chestnuts *(quantity on thousands of tons)*. Years 1951 – 2009



Source: Istat, Foreign trade – Years 1951-2009

1.1 The first period: "the autumn of the patriarch"

The first period, from 1901 to 1950, "the autumn of the patriarch", is characterized by a general decrease in cultivation, however, maintains basically stable overall role of the italian mountain agro-forestry. In the early twentieth century, based on the conclusion of the Agricultural cadastre, it began the publishing of annual data of forestry; for 1910 it was estimated a total area in high forest of chestnut of 652 thousand hectares and a production of 607 thousand tons (Fig. 1). In 1911 it was observed the historical maximun of production: 830 thousand tons.

In the thirties ISTAT (then Central Statistics Institute) [7] realizes the survey on the cultivation of chestnut in Italy – Years 1934-1938. This survey is the picture sharper and more detailed on the role of the chestnut tree in the agricultural landscape and chestnuts in the diet. The survey shows a total area of 532 thousand hectares, and many other characteristics. The number of chestnut trees amounts to 61.7 million, divided into 308 varieties grown in almost all provinces, from 20 to 1,500 meters high.

During "the autumn of the patriarch" in wide mountainous and hill areas, the chestnuts are still the main quantitative component for winter nutrition. After 1937, the production continues to decline, falling to 305 thousand tons in 1950 (Fig. 1); the export is less affected by the production trend and ended the period with 241 thousand tons of chestnuts sold in foreign markets (Fig. 3).

1.2 The second period: "the long winter"

The second period, from 1951 to 1980, "the long winter", is identified as a time of great decadence and the decline of the species itself.

The changed socio-economic conditions result in a strong urbanization and industrialization in view of the gradual depopulation of the mountain. Farmers are attracted by higher incomes, by a different way of life, from increased comfort and opportunity to improve their conditions and a more varied and rich diet.

Especially in the mountains and inaccessible areas, the farming operations normally carried out in chestnut trees (pruning, cleaning theundergrowth, fertilization, etc.) are reduced as well as the actual collection of fruits. During "the long winter" the production of chestnuts is drastically reduced from 332 to 63 thousand tonnes (Fig. 1); while exports reduce from 241 to 167 thousand tonnes (Fig. 3). Althought Italy exported fresh chestnut, it started to import, even if in limited quantities (Fig. 4). In the same period also two also major parasitic diseases (the ink disease and chestnut blight) contribute to the reduction of production and to the abandonment or the cutting of numerous chestnut.

1.3 The third period: "the awakening giant"

The third period, from 1981 to 2000, "the awakening giant", which sets out the first of chestnut signs of rediscovery, followed by a limited but promising economic recovery and the overall enhancement of the multifunctionality of Castanea sativa in the agricultural landscape. The eighties slowly prepare the "awakening of the giant". The consumerism decreases, a different quality of life and a new relationship with nature and environment, are sought, the traditions of the mountain are appreciated, there is growing interest in the product types, organic farming and quality products.

The chestnut controls the loss of cultivated area and, since 1985, the amount was equal to 276 thousand hectares (Fig. 2) while the production and exports show signs of recovery. In fact, the production increases in 1998 to 784 thousand tons, even if it drops to 632 thousand in 2000 (Fig. 1). Exports continue to absorb much of the national product and is, in 2000 equal to 227 thousand tons (Fig. 3) (35.9% of the chestnuts in the year).

At the same time, the import becomes a constant of the external trade of the sector and, after the peak in 1990 with 8.6 thousand tons, ended the period with the entry into Italy in 2000 to about 5.2 thousand tons (Fig. 4).

1.4 The fourth period: "the new springtime"

The fourth period, from 2001 to present, "the new springtime", that shows, though timid and contradictory, chestnut comprehensive reassessment and its suppliers and value added consisted of history, culture, traditions, custom, fruit usage and processing, use of timber, medicinal and dietary properties, handicrafts, tourism, food, enjoyment of the landscape, territorial organization.

This process is not yet reflected in the statistics: the surface does not increase, in 2008 production reduced to 26 thousand tonnes (Fig. 1); in 2009 export decreased to 18,6 thousand tonnes while imports increased to 6,1 thousand tonnes. There is also an increase of the incidence of a new parasitic disease caused by the chestnut Cinipide (Dryocosmus kuriphilus). Generally a more favorable climate for chestnut is observed; proof of this are the 15 PDO (Protected Designation of Origin) and PGI (Protected Geographical Indication) products, 14 of which have already been recognized by the European Union (EU) and 1 in a transitional national protection [8] and over 100 products included in the Tenth revision of the list of traditional agro-industry products [9]. In the recent years there were also numerous Leader and Leader Plus plans financed by the U.E. concerning the chestnut tree. The survey on "Festival of Fruit" performed by the Research Centre for Fruit [10] observed 245 official holidays dedicated to chestnuts in areas with deep-rooted culture and chestnut culture.

In the last decades, scientific research was very interested in depth studies on the chestnut, as botle the numerous national and international conferences and hundreds of publications devoted to the sector, evidenced.

The many recognitions on the multi-functional importance of the chestnut tree in the agro-industry sector, in the agricultural landscape, in rural development and in the consumers perception, are the conditions both for an agricultural and productive possible restarting and for a more dynamic business of chestnuts and processed products in local markets, domestic and foreign.

2 Conclusions

Up to the first half of the twentieth century chestnuts are often a basic component of the winter diet of mountain populations. Currently chestnuts (fresh, dried and pulverized) represent only a very small component of the diet while the qualitative value, the environmental value and multifunctionality of chestnut are increasing.

The Sectoral plan of the chestnut (2010-2013), recently approved by the State-Regions Conference [8], is the regulatory response, cognitive and operational planning for a new approach, including statistical information, the world's chestnut.

Even the official statistics in this sector is required to detect more detail both the physical structures (surface, production, etc..) and the qualitative aspects, economic and social, issues related to rural development and the new agricultural policy of U.E.

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Changing Italian Families and Population Statistics
What we know and what we miss

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In the present paper I will try to provide a brief overview of the changes in family related behaviors since the Italian unification till the beginning of the new century. In doing that I will also try to point out to what extent population statistics have contributed to document, study and measure these phenomena.

The public discourse about family change in Italy

In the public discourse, it is common to refer to present-day changes in family characteristics and behavior as "unprecedented", "impressive", "revolutionary" - with respect to an (imagined) golden age of the family. The argument goes on suggesting that in the past families were large – both due to high number of children and to the frequent cohabitation of many generations and conjugal units in the same house – and stable. Elderly people were respected and taken care of within the walls of the home, solidarity within the family and kin network was strong, young people leave early parental home (a clear contradiction with respect to the presumed high frequency of multiple households) and marry frequently, quickly establishing their own family.

The assumption behind this kind of comparison between past-time and present-day families is that in the last centuries, or decades, there have been a series of *linear* changes in individuals' family related behaviors. From past to present: people are marrying less and at later ages (while having first sexual relations earlier in their lives); when exiting home children establish their separate residence far away from parental home and have rare contacts and exchange of support with relatives; an increasing number of young people is not getting married but simply cohabit with their partner; marital instability has increased at an unprecedented pace; simultaneously fertility is decreasing while a growing number of people remain childless; and eventually, since family solidarity is fading away, elderly people keep living by themselves when getting frail and eventually end up living in a residential home the last years of their life.

Complex and articulated change patterns

Quite differently from what is usually deemed in the public discourse about family and family change, in the last 150 years changes in family related behaviors have been slow, complex and not linear. Furthermore, the extent and direction of family change has been very differentiated across different regions and social classes, and in urban vs. rural areas.

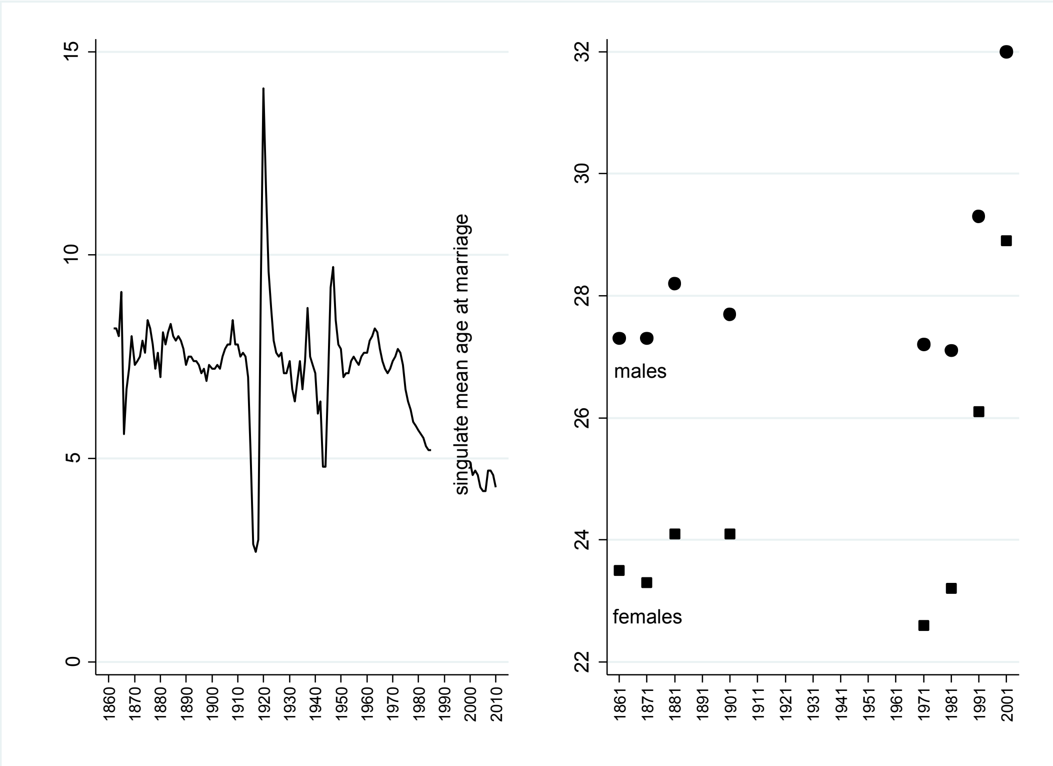
Changing marriages

Population statistics reveal that the propensity to marry – as measured by the general nuptiality rate – is considerably lower today than it was in 1861. In the period between the Italian unification and the beginning of the 1960s there was no systematic variation in the propensity of Italian people to marry (figure 1). In fact, despite in these 100 years there were quite remarkable inter-annual variations, these can be more easily explained by marriage market–shocks connected with wars or deep economic crisis, than by disaffection towards marriage (D'Agata 1969). This trend is discontinued during the marriage boom of the 1960s and 1970s, which mainly involved the birth cohorts born between the end of the 1930s and the mid 1950s. Starting from the 1970s a marked decreasing trend in nuptiality has been registered. This latter trend is partly due to the postponement of marriage by people in the youngest birth cohorts (i.e. those born after 1955), and it is still unclear to what extent this will results in higher percentages of never married individuals. Nevertheless, it is clear that the rapid and significant decrease in the number of marriages, in absence of any major shock in the marriage market, does represent a relevant change in the history of Italian families.

Part of these variations are, of course, connected with the different ages at which people of different birth cohorts marry for the first time (Rettaroli 1992; Barbagli et. Al 2003). Thus, for example, the marriage boom of the 1960s and 1970s was largely due to the decreasing average age at which young Italians entered into marriage. Similarly, the rapid decrease in marriage rate in the following decades is partly driven by an increase in the average age at first marriage for the birth cohorts born after 1955. As a matter of fact, the trend in the mean age at first marriage has decreases from the mid XIX century to the 1960s – particularly for women; whereas in the following decades the trend has reversed. As a result of these changes, at the beginning of the XXI century, Italians are marrying at a much older age than they did in the few decades after the unification.

Despite of the marked variations in the extent to which people marry, changes in the rate of young couples cohabiting without being married have been quite small. In the census of the 1931, among families with at least two members, 2.4% were considered "irregular", that is to say that partners were not married and/or children born outside the wedlock were present (D'Agata 1969). Some decades later, cohabitation among women born between 1945 and 1949 was still below 5%. These numbers increased quite markedly among the following birth cohorts of women living in the northern regions of the country, but remaining well below the levels registered in other European countries (Di Giulio and Rosina 2007: figure 1; Nazio 2007). This delay in the diffusion of cohabitation arrangements among young Italians seems to be largely driven by mechanisms connected with their pronounced dependence on parents' economic support, and the latter reluctance in accepting other living arrangements than marriage.

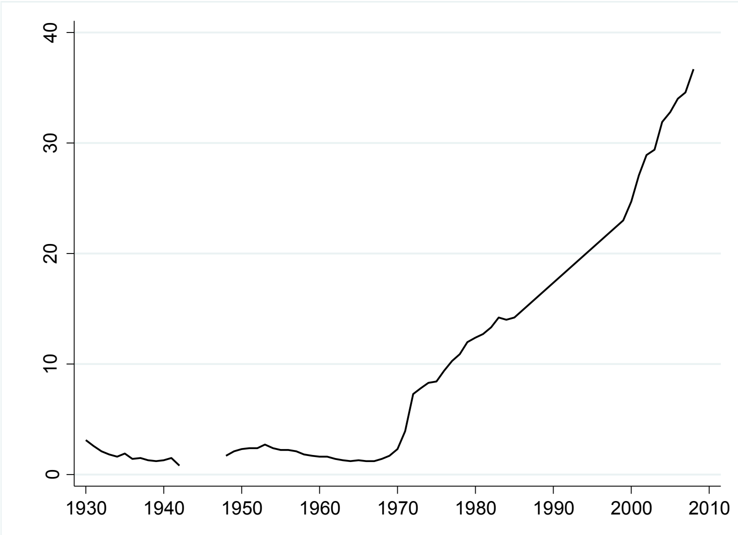
Fig. 1 General nuptiality rate and singulate mean age at marriage



Besides these long-term macro level trends, recently available micro level data and *ad-hoc* surveys allowed researchers to start analyzing the possible causes and mechanisms behind the post-1960s decrease in the number of marriages. The first finding that should be pointed out is that only a small part of this decreasing trend is due to a substitution of marriages with permanent cohabitation. Indeed, not only cohabitations spreads over 10% of all first unions only in the northern regions and among the 1960s birth cohort, but also it has been shown that a large part of these unions do represent a transitory period between the status of living apart together and that of married couple. In other words, in most of the cases cohabitation is a prelude to marriage and not an alternative to it. Secondly, the delay in the transition to the first marriages seems to be driven by a number of different factors. Among the most prominent, and largely investigated in the literature, are: the increasing duration of the educational career and, consequently, the later entrance into the labor market; the postponement of economic independence due to the late entry in the labor market and the increasing quota of precarious/atypical jobs among the young population; parents' and children's aversion to intergenerational downward mobility both in terms of occupational status and consumption levels - the effect of this mechanism has been boosted by the high level of absolute upward social mobility registered during the late 1950s and the 1960s (Saraceno and Naldini 2007; Pisati 2002). Parallel to these changes there has been an increase in the frequency of young couples living apart together, i.e. individuals in long-term partnerships who keep living in their respective parental homes. This phenomenon is related with a marked change in the characteristics and quality of intergenerational relations within the family (Barbagli 1984, Barbagli et al. 2003).

A further change in the behaviour related to marriage has to do with the number of civil marriages. The prevalence of non-religious marriages was quite low in the first decades of the XX century, representing slightly more than 3% of all marriages in 1930. In the few following years this quota decreased significantly, being equal to 0.8% in 1942. In the next three decades the trend remained quite stable, and civil marriages never represented more than 2.7% of all marriages (D'Agata 1969). But, starting from the 1970 – simultaneously to the introduction of divorce – a growing quota of marriages were not religious ones. The numbers have kept increasing also after the initial boosting effect due to the introduction of divorce, notably the trend has accelerated at the beginning of the XXI century. A large part of the increasing trend, which is shown in figure 2, is clearly to be attributed to the number of people re-marrying after a divorce. This is particularly the case for the growth registered during the 1970s. However, the percentage of civil marriages has also grown quite rapidly from the 1980s onward (Barbagli et al. 2003: figure 3.2).

Fig. 2 Percentage of civil marriages over total number of marriages



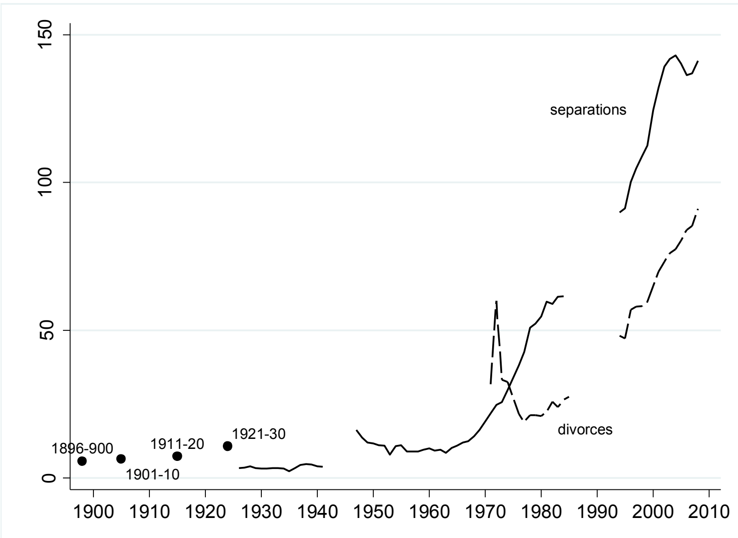
There are also other characteristics of marriages that have undergone relevant and interesting changes. Firstly, the control of parents and relatives over their children's marriage market has considerably decreased; consequently the latter have a higher degree of freedom in choosing their partner (Saraceno and Naldini 2007; Barbagli 1984). Despite of this, it cannot be argued – as the ideology of the romantic love would suggest – that people marry randomly. As matter of fact the relevance of the educational system as a marriage market is increasing, and as a result partners' educational homogamy has been on the increase in the last decades (Bernardi 2002; Barbagli et al. 2003). Secondly, it has dramatically changed the relation between marriage and individuals´ sexual experiences. An increasing number of individuals have their first sexual relation well before marrying, often with a partner different than the one they will marry. More in general, it has changed the relation between moral and ethical values and individuals' sexual life and sexual behaviour (Barbagli et al. 2010; Camoletto 2010). Thirdly, a number of factors (such as the ideology of romantic love, societal cultural change, increasing female participation in the labour market, etc.) contributed to the fact that an increasing percentage of marriages are based on a more equilibrated power balance between the wife and the husband (symmetric marriages) vs. a prevalence in the past of marriages in which the balance of power was biased toward the husband (asymmetric marriages) (Barbagli 1984; Saraceno e Naldini 2007). Next in the few last decades it has grown the quota of marriages in which one or both the spouses were not born in Italy (Balsamo 2003).

Increasing marital instability?

It is commonly assumed that due to increasing divorce and separation rates family instability has grown to unprecedented levels in the last few decades. However, this statement has been clearly challenged by some historical studies showing that family instability due to the death or permanent migration of one partner was much higher in the past than it is nowadays (Saraceno and Naldini 2007; D'Agata 1969).

Furthermore, it is interesting to note that if we consider the separation rate before the introduction of divorce in the 1970, the trend is clearly non-linear – in particular between the end of the second World War and the introduction of divorce the trend is a u-shaped one After the introduction of divorce, however, both separation and divorce rates boosted, and they kept increasing until the beginning of the new century. It is still unclear if the lower pace at which separations increased in the first part of the new century is a sign that, similarly to what happened in other European countries, a plateau in the prevalence of marital break-ups is to be expected in the next few decades.

Fig. 3 Separation and divorce rates (* 100.000 residents), before 2006 averages per year using the number of requested separations.



In recent decades, the collection of data about separation and divorce procedures from the tribunals, new micro-level data and *ad-hoc* surveys have allowed for a more refined description of the characteristics of marital break-ups and the children custodial arrangements after partners' separation. Thus, for example, it is known that: marital separation is more common in northern regions than in southern ones, and among middle classes than in lower social strata; the average duration of marriages before divorce is on the decrease; the number of contentious divorce procedures is also diminishing – despite huge regional differences in their prevalence are still registered, being consensual separations much less frequent in southern regions; the prevalence of joint custodial arrangements had markedly increased from the early 1970 to the early 2000s, then boosting due to the introduction of the 2006 reform (law 54/2006) (Saraceno and Naldini 2007). However, the scant availability of large longitudinal data set (being the sample size particularly relevant here due to the low number of separations) does represent a clear obstacle to the further exploration of the causal social mechanisms (and not simply the correlates) behind marital dissolution, and the analysis of its consequences on ex-spouses well being, children well being and intergenerational relations. Despite of this, recent demographic and sociological research has significantly contributed to shedding light on the causes and consequences of separations and divorces in Italy (Barbagli e Saraceno 1998; Todesco 2009; Albertini and Dronkers 2009; Albertini e Saraceno 2008; Tomassini et al. 2004; 2008; Livi Bacci and Mencarini 2009; Meggiolaro and Ongaro 2010; Ongaro and Mazzucco 2009)

Previous analyses on the determinants of spouses' separation in Italy suggest that the event is positively correlated with partners' cohabitation before marriage, spouses' educational level, women employment, and the divorce of spouses' parents (intergenerational transmission of divorce). Also, it is an open issue in the literature if the presence of children negatively affects the likelihood of parental divorce, or simply leads to a postponement in spouses' separation. As for what concerns the consequences of divorce on the well being of the ex-spouses, it has been shown that *ceteris paribus* divorced individuals are usually faring less well than married ones with respect to average income and economic poverty risks. This negative correlation is stronger for women than for men. It is also shown that marital disruption negatively affects women's fertility. Statistics show that children of separated parents have worst educational outcomes than children from intact families – although this disadvantage tends to disappear at increasing mothers' educational levels. Also, similarly than their parents, children of divorce are at higher risks of economic poverty. More in general, parental separation leads to less traditionalistic family behaviors of children. Eventually, a considerable amount of empirical evidence points to the fact that intergenerational relations are negatively affected by parents' separation; however this effect is markedly different depending on the gender of parent/child and the specific relation considered i.e.: contact, exchange of social support, financial support.

Less children and more childless couples?

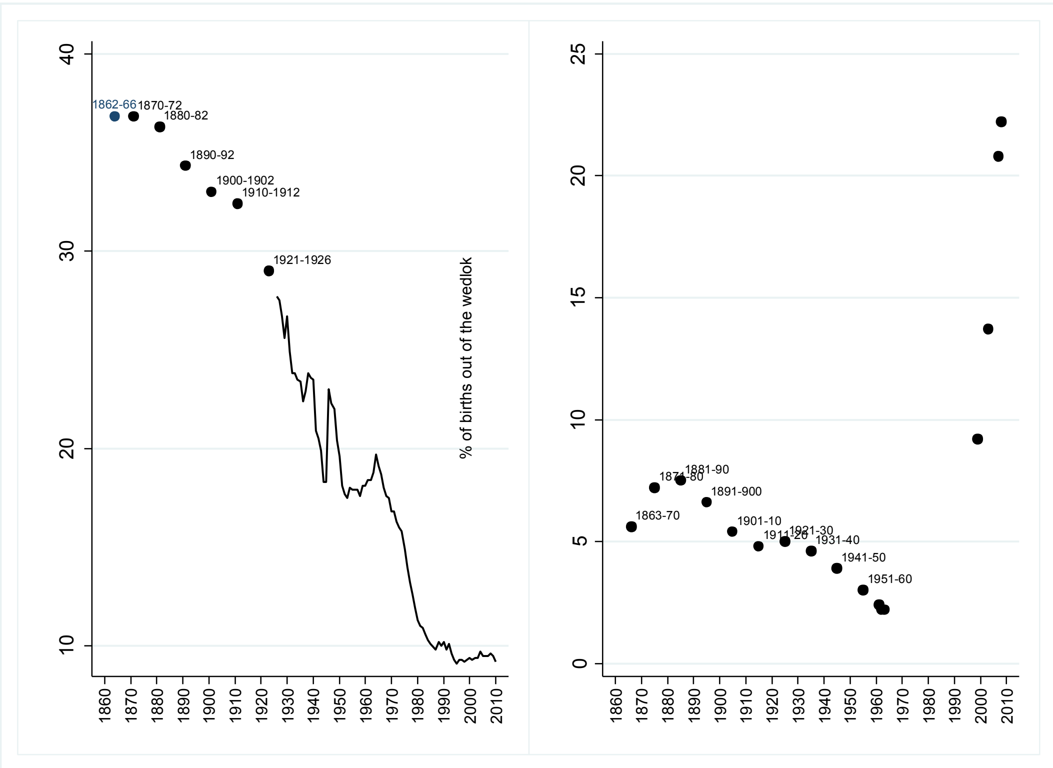
The transition to a low mortality and low fertility regime in Italy took place later than in other European countries. In fact, the reduction of fertility started in the last decades of the XIX century and, thus, slightly after the Italian unification. The process, however, took place at a different time and pace in the different areas of the country – generally speaking moving from north to south and from west to east. The highest levels of dissimilarity in fertility behavior between the different regions were registered during the 1930s. Overall the process of the transition from natural fertility to a low fertility regime has lasted around 60 to 70 years – starting in the 1880s in Liguria and Toscana and ending in Sardegna during the 1950s (Livi Bacci 1980; Livi Bacci and Breschi 1992). After the transition to a low fertility regime, however, the birth rate has kept decreasing. Despite a rapid but short-lasting increase in the 1960s, the reduction in the number of births has been quite rapid until the 1990s when, apparently, the trend flattened (figure 4). Birth rate levels at present are particularly low and there is a general consensus in indicating the Italian situation as one of lowest-low fertility (Billari and Kohler 2002). It is worth noting, however, that it would seem that significant inflows of young immigrants have offset, for the time being, some of the most negative demographic consequences of such low fertility levels (Dalla Zuanna e Billari 2008).

The causes of the decreasing number of children have been extensively investigated in demographic research, and providing a summary of this research will take far more space than is available here. However, simplifying we can argue that some of the most relevant factors behind the historical decrease in fertility are: the decreasing mortality rate at young ages, the changing relation between family organization and the organization of economic production, the adoption of efficient contraceptive methods and devices, the increasing investment in the "quality" (i.e. education and informal care) of children, the increasing relevance of individuals self-realization in legitimating conjugal unions (king couple), the postponement of marriage, the increasing participation of women in paid labor market.

What has changed in the last 150 years of Italian families history is not only the number of children, but also the relation between parents and children within the family. Despite the documents and data available on this relation are quite limited – in terms of reliability, richness and representativeness of the entire population - it has been generally argued that in the last century parent-child relations have become more affectionate, less formal, more intimate and less informed by the authority of the father (from patriarchal to intimate family) (Barbagli 1984).

Despite the considerable reduction in fertility, and the fact that fertility is much lower in Italy than in most of the other European countries, it has to be noted that childlessness rate is not particularly high both in comparison to levels registered in Italy at the beginning of the XX century, and present-day values observed in other European countries. As a matter of fact, the rate of childlessness for Italian women born between 1955 and 1959 is considerably lower than those registered for Italian women of the 1900-04 and 1905-09 birth cohorts, and also much lower than the levels characterizing same-age women in Finland, the Netherlands, Belgium and Germany (Rowland 2007).

Fig. 4 Birth rate and % of births out of the wedlock



Parallel to the slow and late increase in cohabitations, a quite reduced number of births out of the wedlock was registered for a long period after the Italian unification (figure 4). A few years after the Italian unification births out of the wedlock just represented slightly more than 5% of all births, this percentage has increased in the following decades reaching a peak in the period between 1881-1890. Starting from the last decade of the XIX century, the value has continuously diminished reaching 2.2% in 1963. In the last few years, however, the number of children born from unmarried parents has considerably increased, summing up to more than one fifth of all births in 2008. This change in family related behavior is of paramount importance from the perspective of family sociology. Indeed it signals a marked change in the social understanding of the relation between family and marriage.

Family solidarity at risk?

On the basis of data showing a decreasing trend in the number of multiple generations households and in the residential proximity between parents and children, it has been argued that family ties in Italy are weakening, family solidarity is diminishing and the provision of adequate support to dependent individuals is out of reach of modern Italian families.

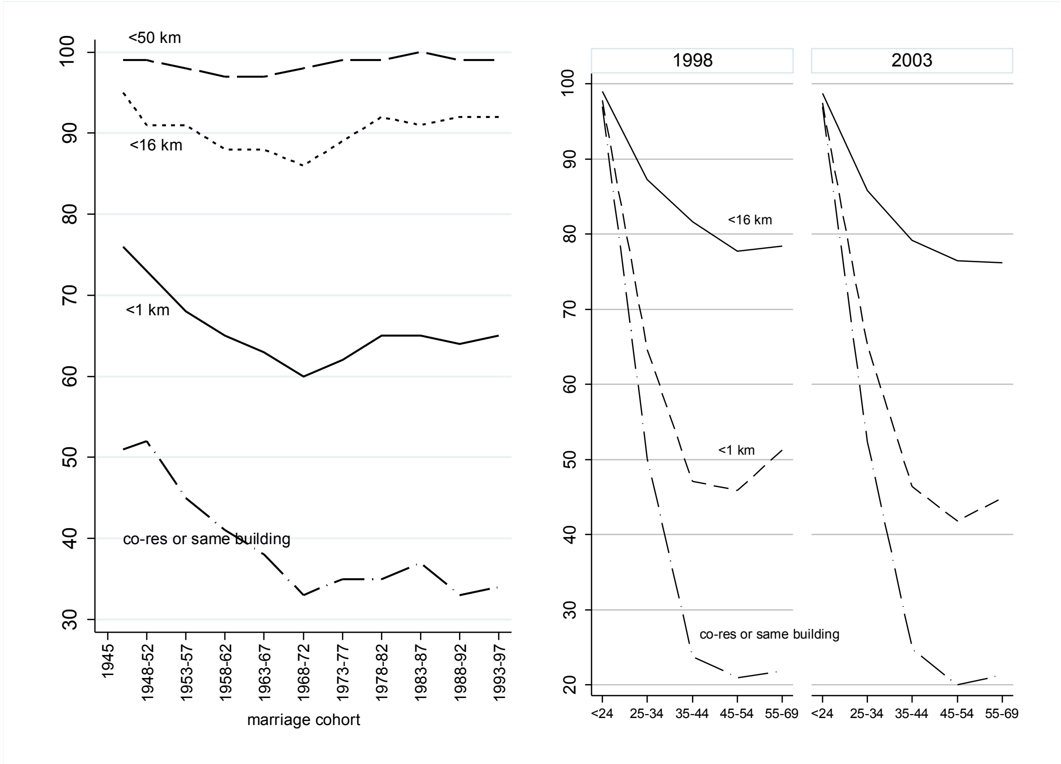
As a matter of fact, it has been common practice to indirectly study family solidarity by analyzing intergenerational co-residence and living proximity. This is mainly due to the scant availability of other types of data regarding family relations beyond the co-resident nuclear family (Levi 1992: 307). Other information about family relations in the past can only be collected on the basis of personal communications (letters) or diaries. However, not only the search and analysis of this material is particularly demanding, but also there is a clear bias in the social classes for which this information is available and in the type of information that is reported in these documents (Barbagli 1984). Recently nation-representative and quantitative information on intergenerational contacts and exchange of support between non co-resident individuals have become available. (i.e. 1983 survey "Strutture e comportamenti familiari"). However, this type of information is still generally missing in longitudinal databases. Moreover, the variables collected are often insufficient to provide an accurate description of within-family – and in particular intergenerational – relations along the individuals' life course. For instance, the information collected in the recent 2003 survey "Famiglie e Soggetti Sociali" does not allow for analyses of intergenerational relations in terms of parent-child dyads).

During the 1950s and the 1960s the leading hypothesis regarding the long-term transformation of family structures in Western Europe was that in the past the multiple generations family was the prevalent family form, whereas after the industrial revolution nuclear families were the most frequent. A number of studies has confuted, or corrected, this quite simplified version of the history of families in Europe (Viazzo 2010). Nevertheless, despite the non linearity of the transformation, it has been shown by Barbagli that in Italy the rapid industrialization and urbanization of the 1950s have lead to a marked process of nuclearization of families (1984: 121). Next, among those who married between 1948 and 1972, the distance between parent and children's place of residence increased. On the basis of these data a number of scholars argued that in post-WWII Italy family solidarity and ties were weakening.

However, the decrease in living proximity registered in the three decades after the Second World War is likely to be due to the migration of large quotas of population from the southern regions to the industrialized north (Barbagli et al. 2003). In fact, the trend has flattened and reversed in the following marriage cohorts. And, in addition, further analyses of living distance between children and their mother at the end of the 1990s and the beginning of the new century reveal that there has not been any dramatic change in these figures – despite some decrease at higher ages is registered (figure 5).

Following these data and also the results of cross country comparison in intergenerational co-residence in modern Europe, some authors argued that the strong ties family model of southern Europe (Reher 1998) has survived major social and economic changes of the post-mid century compromise societies. Moreover, it has been suggested that by looking at increasing propensity of Italian parents to financially support their children's home ownership, one could also argue that intergenerational solidarity has increased in recent decades (Barbagli et al. 2003: 189).

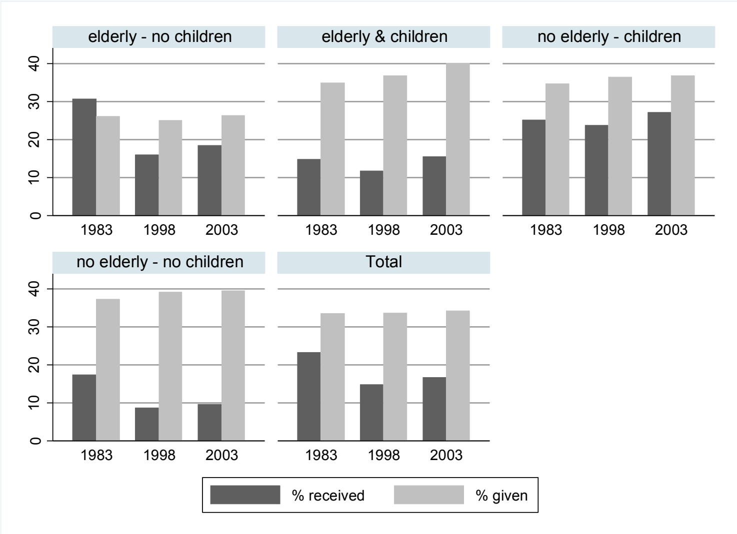
Figure 5: Living proximity between children and the closest parent after marriage, by marriage cohort; mother-child living proximity by age group of the child, cumulative percentage.



One clear limitation of analyzing family solidarity by considering intergenerational living arrangements - or living proximity - is that the contact and resource exchange between non co-residing family members cannot be directly observed. This poses a serious limitation to what we can argue about the transformation of family solidarity. Due to data availability limitations, concentrating on the exchange of social and economic support between the generations only allow us to observe quite recent changes in family relations. However, I think it is worth doing that because it helps us giving a full account of recent changes in family solidarity.

The data shown in figure 6 show that the quota of families providing support to someone outside the household has increased, or at least it has not diminished, in the period between the early 1980s and the beginning of the XIX century. The growth is particularly marked for two types of families: (i) those in which both at least one elderly person and one child are present; and, on the opposite (ii) those in which neither an elderly person nor a child are included. The pattern of changes, however, is quite different once we concentrate on the quota of families that has reported having received some support from outside the household in the four weeks previous to the interview. Here the general trend is a decreasing one, with families with at least one elderly member (but no children) suffering the larger decrease. What remains unclear is the source of the differences between the trend in support given and that in support received.

Fig. 6 Percentage of families that have received or given support from/to outside the household, by family type



Additional and more detailed data on the support provided to individuals outside the household confirm an increasing trend in family solidarity between the end of the 1990s and the beginning of the new century (figure 7). In particular, it has markedly increased the quota of women aged between 34 and 54 years who provide support to parents (their own or of their husband) and, also, the percentage of women aged 55 or more who provide support to non co-residing children. More in general, in the five years considered it has augmented the provision of support to parents among the so-called "sandwich" generation, and the support given to children by parents aged 55 years or more. Furthermore, additional signs of increasing family solidarity are recorded in three-generations relations. In fact, the quota of grandparents taking care of young grandchildren (i.e. less than 14 years old) on a regular basis - that is to say when parents are working or the grandchild is ill – has increased, whereas it has remained stable the percentage of those who never take care of the grandchildren (figure 8).

Fig. 7 Percentage of individuals (by age and gender) who provide unpaid support to someone outside the household in the four week previous to the interview, the recipient of "the most relevant support provided" is reported.

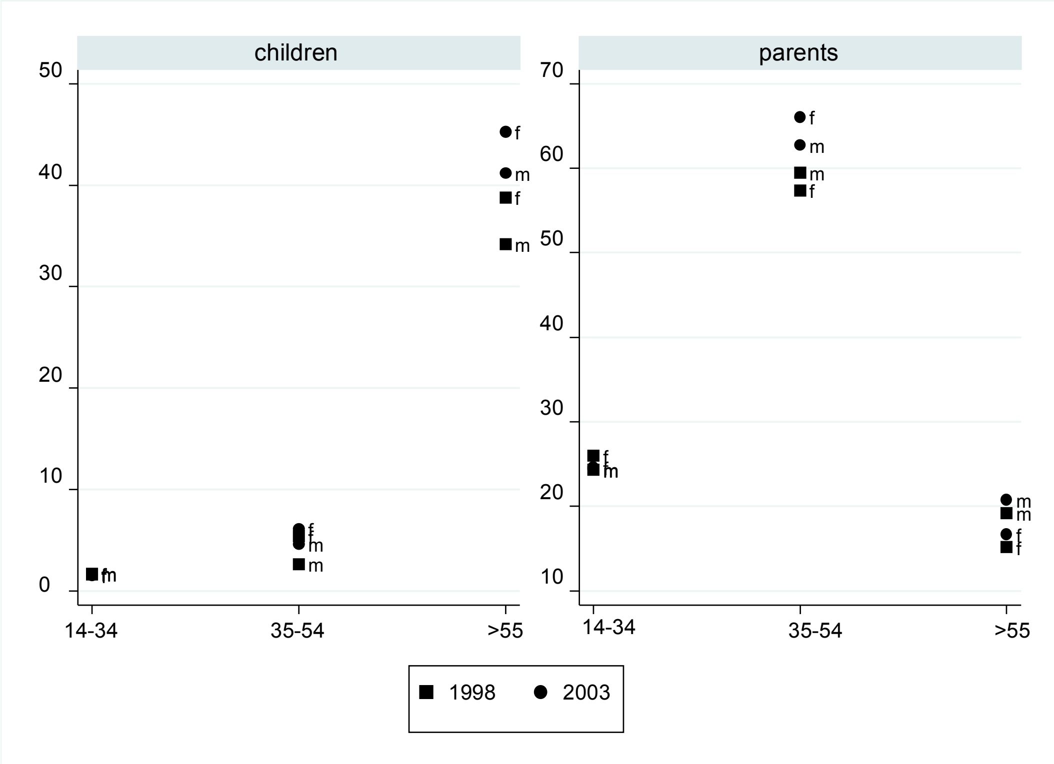
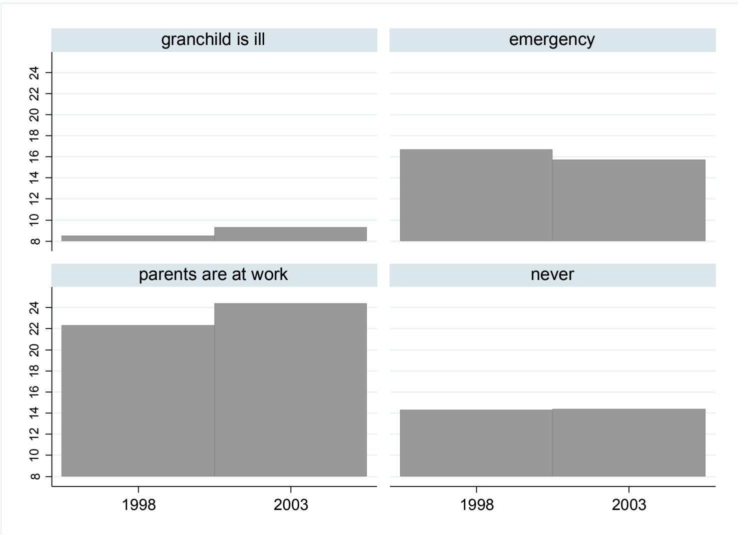


Fig. 8 Percentage of grandparents taking care of their young grandchildren



Concuding remarks

The last 150 years have witnessed marked changes in Italian families, under many different aspects. On the one hand, population statistics have contributed to document, study and measure these phenomena. On the other hand, the way in which statistics were collected, disseminated and made available to the scientific community have been largely influenced by family changes and by the desire of scholars of understanding the micro-level mechanisms behind social change. Thus, parallel to the development of research in the field of family studies, available population statistics have changed from macro-level data concentrating on essential characteristics and dynamics of the Italian population, to micro-level longitudinal data.

Initially, when only aggregated macro level (census) data were available a few family related behaviors could be described and analyzed – and in the very beginning not even this was possible since, for instance, the two first population censuses (1861 and 1871) consider as unit of analysis the "focolari", that is people having their meals together usually or temporarily (i.e. including individuals living in barracks, hospitals, etc.). An exploration of the social mechanisms and explanations behind these macro level figures was only possible by speculating on the geographical variation of the phenomena at study, or on the regional differences in the timing, extent and pace of changes. In later decades the availability of micro level data made it possible to explore the social and economic correlates of some family related behavior, both at family and individual level. The most recent development is the collection of longitudinal data.

However, In Italy the availability of large (in terms of sample size) and rich (in terms of variables registered) longitudinal data sets remains quite limited. As a consequence a significant number of phenomena related to family behavior cannot be studied. The study of intergenerational relations is a good example of what we still miss in population statistics. We do need large longitudinal data sets, because family solidarity is a phenomenon that spans along the entire life course of at least two – if not three – successive family generations. Next, it is an intrinsically multidimensional phenomenon – thus, requiring data on demographic and economic characteristics, attitudes and values, health situation, etc. We also need data that allow reconstructing family relations on the basis of dyadic relations between each parent and each child.

In general, a further limitation in available data is that concerning information on individuals' attitudes and beliefs about specific family related behaviors (e.g. the gender division of unpaid household and caring work; separation and divorce). It is often the case that we do have this information at one point in time, but we cannot observe how these attitudes and beliefs have changed over the individuals' life course. This information would add to our knowledge of the cultural causes of family related behavior, which usually enter in our analyses as a "residual" effect: i.e. everything that cannot be explained by the socio-economic characteristics and behavior of family members.

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Social changes and statistical information: the development of Italian statistical production process.

Biagio Aragona

Abstract
The paper presents some changes which have occurred in the Italian statistical information production process in order to pursue the social transformations which have token place since Italian unification through nowadays. Throughout 150 years, the role of statistical information has shifted from mere answer to governmental needs to support for claiming civil rights by local authorities and citizens. The paper underpins five main phases of this shift, which can be detected in both public action and statistical production reforms. These transformations have generated what the author calls "new data culture", whose characteristics can summarised as follow. First of all, the implementation of a total quality approach. Secondly, the transition from single surveys and censuses to integrated informative systems based on different sources. Finally, the adoption of an user-oriented dissemination process, able to relevantly suite the different informational needs.

1 Data culture

At the end of Eighties the concept of 'data culture' was introduced by Sgritta as: "the constant and strong relationship between the production of statistical data and their use in solving theoretical and practical issues" (Sgritta 1988)[2].

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[2] Free translation of the author.

The author underpins two main dimension of this concept. First of all, the quantity of statistical information which is dedicated to the analysis of society and secondly, the set of methodological, technical and managerial changes which represents statistical production systems at any given time.

Since Italian unification several changes have occurred in the statistical information production process in order to pursue the social transformations which have token place in our country. Throughout 150 years, the role of statistical information has shifted from mere answer to governmental needs to support for claiming civil rights by local authorities and citizens, becoming: “a public good which everybody can use to pursue its scopes; a vital condition for action, decision and choice in a complex environment…” (Sabbadini, Sgritta, 1997)[3]. According to Trivellato (2002), social transformations have brought about five main consequences on statistical information:

- Growing number of dimensions to document;
- Thickening of spatial relationships;
- Faster and more intensive changes;
- Growing relevance of families, enterprises and other social actors;
- Greater complexity of phenomena.

The historical development of these processes on data culture can be detected in both public action and statistical production reforms and may roughly be split into the following five main phases.

2 Data culture: past and present

The first phase of data culture is dated in the Fascism period, when the Italian statistical office (ISTAT) was founded (1926). Tough from the beginning ISTAT was concerned with dissemination of statistics, at that time it represented a governmental office whose objective was to satisfy national needs and its data were barely used for purposes other than administrative ones.

Between World War Two and the Seventies two periods of data culture can be identified (Benvenuti, 1998). Between Fifties and half Sixties economics and social analysts were autonomously collecting their empirical material while statistical authorities rarely disseminated their data for mere research purposes. The second period began when the State took over the control of welfare policies. At that time, in Italy it was ought to suite the rising statistical needs of policy makers in order to answer to new social risks

[3] Free translation of the author.

brought about by affirmation of capitalistic society (urbanisation and industrialisation) and post economic boom unemployment. Moreover, local authorities were claiming to create a decentred governance level, Regions, which were finally constituted in 1970 (Cassese, 1980). As a consequence of the former there was an extension of ISTAT activity to new statistical domains such as social surveys (i.e. Multipurpose surveys), which gradually overcame the primacy of economics statistics in ISTAT production. As a consequence of the latter there was a reconsideration of the statistical information asset in the country (regional-vs-national) which finally ended in 1989, when n.322 law was approved and the SISTAN was founded [4].

That was the begin of the forth phase of statistical information in our country, where new official statistics actors got in the scene and informative pluralism, as well as administrative pluralism, started. Accordingly, in the early Nineties a wider process of institutional reform began (Pavolini 2003) and the old process of internationalisation of statistics became more fruitful. At the end of the Nineties statisticians, economists, sociologists and other users hoped for creation of a common "language" of concepts, methods and techniques.

That was accomplished between 1997 and 2001, during the fifth stage of data culture, when two main reforms were approved to rule on one side the internationalisation of statistics and on the other side the devolution of some policy domains to local authorities. Firstly, the so-called statistical law of 1997, whose objective was the division of responsibility between national and Community statistical authorities and the adoption of subsidiarity in the production process. Moreover, the Constitution Titolo V reform, which finally assigned to Regions full power concerning health, social and education policies. As a result, SISTAN and ISTAT has stareted to accomplish international as well as local informational needs.

3 A new data culture

At the present time a question arises, is data culture in a new era? The changes described above, along with the ICCT development of past twenty years may be seen as indicators of a new data culture? To say it in ISTAT president Enrico Giovannini words, has Italian statistics got trough "the next level"? (Giovannini, 2010). It is hard to answer this question but it is possible to depict the main features of what it is (will be) the new data culture.

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[4] A review of statistical asset reform projects could be found in Guerra, M.P., 1990 and in Parenti, G., 1987, who underlined the need of a statistical network. About the role of Regions in statistical information see also Curatolo, R., 1979 and D'Alberti-D'Alessio, 1979.

First of all, the implementation of a total statistics quality approach, and the adoption of an user-oriented dissemination process able to relevantly suite the different informational needs. In this perspective not only accuracy, but also, relevance, comparability, accessibility, timeliness and punctuality are main features of data quality. The value of statistics has to be addressed analysing the trade-off between relevance and comparability, between the ability to meet users needs and the necessity to compare data at local, national and international levels. Secondly, a complete transition from single surveys and censuses to integrated informative systems based on different sources. The role played by technology is therefore crucial for both data collection (i.e. use of CAPI and CATI) and dissemination (website, datawarehouse). Finally, a key role of ISTAT in the governance of statistics. The ability to get into the next level lies in the ability to well balance both vertical and horizontal dimensions of multi-level statistical governance, and gather international and local needs as well as governmental and general users objectives.

According to Trivellato (2002), the satisfaction of these, partly in conflict, needs is the key to enforce the relationship between the production of statistical data and their use in solving theoretical and practical issues. Beside that a cultural process is also needed, more statistical literacy is demanded and the involvement of researchers as well as policy makers are the means to turn statistical information producers into knowledge builders.

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Social aspects on censuses and official surveys in Italy

Enrica Aureli and Mariangela Verrascina[1]

Abstract The first Census on Population was carried out in the same year of the Italian unification (1861). This paper analyses the increase of official statistics over the last 150 years, which have changed from purely demographic statistics to statistics on even economic and social fields. The latter ones, although present from the earliest statistical yearbooks, currently cover all areas of social, and use the advanced methodologies of the large sample surveys.

Keywords: census, social statistics, social indicators

1. From the first census to the birth of the Central Institute of Statistics (1861-1926)

The first population census in Italy (1861) responded to the need to provide politicians with the background elements of the new political reality that was created with the birth of the Italian Kingdom. The aggregation of many different realities was leading to the birth of a nation and to the characteristics of the people who would go on to create it and highlight the specific needs and the potential success of policy measures and administrative systems that would result in the dismantling of the previous administration. Thus, in the same year as the unification of Italy, 31 December 1861, the first population census was carried out, with the aim of *"defining the basis for the realization of the Kingdom and of perceiving the people's sense of belonging to it. The urgency to know not only the number, but also the natural conditions and civil rights of the people led to critical information in determining many rights and many civic duties, but also the laws governing the most precious of political rights, the electorate"*. On one hand, the first census collected personal data such as marital status, age, place of birth from which the electorate could be deduced, and working conditions as well as temporary migration for work. But it also highlighted attention to social issues as it

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considered religion and spoken languages in order to identify minorities located in the territory, the level of literacy in terms of being able to read, to write, and the conditions of handicaps, though only limited to the deaf and blind.
A statistical yearbook, edited by Cesare Correnti and Pietro Maestri, had already been published in Turin by 1858, before the first Census. Such a yearbook presented *"the image of Italy as it was in those days, both a servant and divided, but already with an awareness of its unity and full will for a rebirth."* Despite the good intentions of the authors, who set out to achieve an annual publication, we had to wait until 1864 for the Second Italian Statistical Yearbook. This yearbook tended to read data and highlight regional differences, pointing out where they had occurred and the homogenization efforts that were put in place. Two chapters titled "Medical Statistics" and "Intellectual Italy" were devoted to social issues. The first bore the subtitle "Hygiene of the army", and military doctors were the first to realize the regional differences in the spread of disease. The figures given in this respect related to the movement of soldiers treated in military and civilian hospitals in the kingdom and differentiated by those present, dismissed, and who were dead, with an initial mortality rate calculated on the treated patients. The data on intellectual Italy is presented in tables on university teaching and on the secondary teaching divided by compartment areas; on schools by type and by territorial compartment and students attending. The last table of the chapter shows pupils at primary schools divided by sex and compartments, and a first percentage index was calculated relating students to the overall population.
The next censuses in 1871, 1881, 1901 and 1911 followed the approach of the first one with small changes of little significance, adding paternity to the demographic data, omitting the spoken language and even religion in 1881, and implementing, however, between 1871 and 1901, the disabilities detected. The first (1871) specified blindness in both eyes, deaf and dumb, simple, simple-minded and simpleton. In the second (1881), the disabilities found were reduced to blind, deaf and dumb, and in 1901 only the categories of deaf-mute and blind were defined. A more accurate specification of the work of the householder required the disclosure of the head of the family's occupation, which drew most of the means of subsistence, and then those of lesser importance is required both in the census of 1881 and in 1911. Such specifications foreshadowed the interest in the employment structure in terms of location and economic class and in relation to the possibility of self and family support from segments of income of different importance. Starting from the 1881 census, an interest in respect to foreigners in Italy is shown, and their nationality is required. By 1911 the duration of stay in Italy is also collected. From 1901 onwards, the attention to aspects of economic statistics relating to the profession is emphasized with more detail required regarding the status of the employed/unemployed (in the 1901 Census and then ignored in the following two) and the "role", what today we would call "status in employment", which would be required in all censuses from then on.
During these years the perspective from which we look at the statistics also changes. The "1890 Yearbook of Statistics", published in Milan by Attilio Brunialti, helps to understand the cognitive interests that have developed in the meantime in absence of the 1891census. The Yearbook is largely set out according to the administrative reorganization of the Kingdom and the events that happened in that year, although the author stated that "1890 will be remembered as a very average year". However, the real statistical information section is extended to the Italian press, education, charity and justice. An appendix to statistics of religions appears, although it refers to the distribution of religions in the world and not to Italy. A brief statement of six pages also appears, describing the economic and social progress of Italy from 1861 to 1889. It

summarizes, during such a period of time, the trends within the above mentioned social fields that are all expressed in absolute values. Interesting to note is the care with which they looked at the press and in particular its ability to provide some basic indicators: the information that 185 journals published in 1836 passed to 1596 in 1889 and was joined by the data that, at the beginning of the period, indicated there was a newspaper for every 119 thousand inhabitants. By the end of such a period of time the rate had passed to a newspaper for every 20 thousand inhabitants, over five times more. The distribution frequency and topic were also provided in addition to the list of all periodicals and the distribution per language used.

Such a growth in the printed media is matched by the increase in literacy and schooling. In the 1890 Yearbook, the author shows the rates of literacy found among the spouses at the time of marriage and the number of those enrolled in primary schools for every 100 people between 6 and 12 years divided per region. The result of the enrolled members of the age group of reference points ones attention to the use of more appropriate indicators than in the past, so that the difference in schooling at the regional level is put in evidence. However, more attention is devoted to the statistical evolution of the phenomena related to education, both in terms of structure and of cost and fruition. The evolution of university courses in the observed period of 20 years was also followed, and the distribution of University students per site and faculty were provided. The interest in public charities highlighted in this yearbook derives from the approval by the Parliament of the relative Law in that same year. However, statistically it could not provide any information yet. The Yearbook provides, however, the condition of the charities present on the territory and the availability in the budget of municipalities and provinces to offer, in the future, a comparative tool with the effects of the new law reforming the sector. Thus one can see a beginning of the use of statistics to assess the success of public policies.

The civil and criminal justice data contained are understood as "evidence of the moral movement of the country". A first table shows the proceedings initiated before the various courts and divided by district court of appeal, providing absolute figures and rates per 1000 inhabitants. Then it continues with great detail on the types of cases and proceedings foreshadowing what will from then on be the judicial statistics, all guided by the procedural aspects of administrative provenance. On the other hand the statistics for criminal justice give an account of the more limited articulation of the offences at the time. The voices are summarized into six types: murders and robberies with simple homicide, wounds and beatings, crimes against public morals and families, robberies, blackmail, extortion, robbery without murder and skilled and simple theft. Hence, it is easy to understand what was meant when they talked about the current morality of the country. In fact, Brunialti concludes: "*The condition of the city worker has certainly become better. Rents are more expensive but the houses are far better. The price of clothes has diminished, but not that of meat, but that of other foods has decreased. In short, whatever one may say, the economic conditions of workers have come to improve a bit more than the moral conditions*". Such a conclusion would seem a first attempt at analyzing quality of life.

The 1921 census did not record any significant change in the survey pattern and the information of a social nature that derived from it, as one might have expected as a result of the social changes associated with World War I which had just finished.

The use of administrative data from the education system allowed for the editing of a volume of "summary of data on the middle and normal school institutes from 1909-10 to 1911-12", whose attention to gender is interesting as an entire chapter is devoted to women present in those institutions.

2. From the establishment of the Central Institute of Statistics to the small 1936 Census

A shock to the organization of statistical production in Italy derived from the sixteenth session of the International Institute of Statistics held in Rome in 1925. Until that time statistical production had been limited to the information needed by individual ministries and government departments. However at that time, the scientific community stepped forward with a strong need for coordination of statistical production that led to the establishment of the Central Statistical Institute, reporting to the Head of Government and replacing the Central Bureau of Statistics which was anchored to the Directorate General of Labour Statistics and the Ministry of Agriculture, Industry and Commerce. This new collocation emphasized its role as an instrument for decision making (*numerus rei publicae fundamentum*) exceeds the purely advisory role of the former Superior Council of Statistics.

However, the Census of 1931 and the small census of 1936, follow the establishment of the previous censuses, but show some signs of the kind of information that the political power required with more attention. In fact, in 1931 detailed questions were introduced for the first time on the age of women at the time of marriage, on any second marriages, on the number of children born and the number of children living. This was clearly related to the population policy of the regime. From the perspective of work, the field of economic activity was introduced, and it would be kept in all subsequent censuses. In both censuses of the period, a strong focus was placed on the flows of migration to the colonies or to foreign countries. Such information was also of great interest to politicians of the time who were aiming at the colonization of the countries of the empire and strengthening the Italian population numbers that were seen as a representation of power.

Throughout the period the propensity to systematize the availability of data in education is consolidating. In the “Statistic intellectuals” series, every five years single-issue volumes at various levels appear: elementary education, secondary education and higher education intended as university education. We also find a monograph devoted to the statistics of some Italian cultural events in the period 1931-35, containing information about libraries, book production, archives, intellectual property, museums and institutions of art, film, radio and freelance professions. Data reading started using the advanced methods of statistics in which the frequency data is replaced by historical or indices of composition data and also data derived from, i.e., pupils studied in relation to sex and type of Institutes per compartment.

In presenting the data, Savorgnan, then President of Istat, emphasizes the temporal increase in those attending school, linking it to the increased spread in the demand for education but also highlighting the reduction in quotas per school year compared to the following year and linking that to the growth in newcomers entering their first year at school. Though he also assumed, with minor emphasis as if it was not permissible to say, what nowadays is called early school leaving. The statistics on primary education in that year, referred to the same period, reported data on illiteracy noted by the two previous censuses: illiteracy, according to the acts of marriage and illiteracy among those enlisted in the army, which is a first attempt to integrate sources. In 1936 a monograph dedicated to students enrolled in universities and high schools in the academic year 1931-32, was also published perpetuating and expanding on a similar survey conducted in the academic year 1926-27. The survey presented was very innovative because it did not just provide detailed information on the faculty, students and courses within a comparative perspective with the academic year 1911-12, but introduced two new dimensions of study: the spatial mobility of university students according to the attractiveness of the premises and the social class according to their father's occupation and their willingness to follow their father's education or career. Official statistics illustrate the attempts of the period to search for an autonomous role, but serves primarily the function of producing data for the management of public affairs and government policies. We find confirmation of this in a paragraph dedicated to the students belonging to the “Gioventù Italana del Littorio” within the statistical data on middle school education for the school year 1936-37 which included the statistics data from 1932-33 to 1935-36, and in the census of Jews carried out in 1938 by the General Directorate of the Ministry of Race, with the approach of World War II.

3. From the post-war reconstruction to the financial boom: sample surveys, special surveys

The war resulted in the failure to complete the census of 1941 and thus led to, in September 1944, the realization of the "Census and Surveys for national reconstruction". This was done in 38 provinces of liberated Italy, in accordance with the commitments made between the Allied Commission and the Presidency of the Council of Ministers. The agreements forced the adoption, within two months, of four general censes (population, agriculture, industry and merchant marine) and thirty surveys and extended surveys on all major aspects of national life. Within the Social environment surveys were carried out on living conditions, food, clothing, housing, public health, primary and secondary education and public services. Implementation difficulties imposed the use of estimates, even if it was not possible to obtain the data and the whole experience was a turning point in the approach to producing official statistics as expressed by the Director General of Istat, A. Molinari, "*The usefulness of official statistics is now greater, the more pronounced is its nature of "topicality" in comparison to those predominantly "historical": especially when the preparation of "plans"- which must forcibly be rooted in statistics - occupies a prominent place in the activities of the state*".
The first real post-war census of 1951 is confronted with the need to comprehensively determine what the demographic, economic and social base on which the country's recovery had to be based. The new national territory, which involved new borders and a flow of refugees from territories no longer administered by Italy, and the return of refugees from former colonies in Africa, demanded that the survey include a question on "Refugees". Hence there were new types of people whose needs and demands the political power had to provide answers and assistance to. In addition, questions on housing and services available that detect the persistence of poor housing, both in relation to crowded conditions and cohabitation and the lack of services, were introduced.
The Official statistic in this period was aware of its own potentialities and requires going beyond the mere certification of the state of the population. This was also described at intervals which allowed the detection of changes in the long term without giving an immediate response to any short-term phenomena. In 1952, according to the methodological developments of the discipline and techniques of sample collection, the first sample survey on the Labour Force took place, followed by three more completed, not systematically, but in any case every two years (1954, 1956, 1957) and reaching, in

1959, a quarterly survey for a project that would become routine. Such a methodological boost is significantly attributable to the role played by the president of Istat, Maroi who designed and created also the dissemination of statistical data according to a new set of systematically issued monothematic directories, mostly on the social field. The first Yearbook of judiciary Statistics appears in 1949 followed by the Yearbook of Italian Education Statistics in 1950, the 'Directory Statistics Assistance and Social Security in 1951, the Yearbook of Health Statistics in 1955, the Yearbook of Statistics of Emigration, again in 1955 which then became the Yearbook of Labour Statistics and Emigration in 1960. All these could benefit from systematic and comprehensive information from public administrations which helped to strengthen the role of ISTAT as the Central Institute of Statistics.

The experience gained from sample techniques that had the aim of the study of the labour force and the labour market, provided methodological tools and impetus for the use of such techniques for the acquisition of information in specific areas and in other social areas in general. Already, by the beginning of the decade, a "special investigation on the age distribution of pupils in elementary and middle school" for the school year 1952-53, was completed. In the late 50's a survey, published in 1959, "on the educational and career choices of pupils in secondary schools" was completed. This also represented a change in the policy of the Institute which, on this occasion, provided its own skills including organizational skills. This was not only at the request of the Government but also in cooperation with scientific institutions, in this case, the Institute of Social Psychology of Turin. In presenting the supplement of the Italian Education Statistical Yearbook of 1955, dedicated to the "special survey on college students and graduates of high schools", Maroi wrote:" *I am confident that the present research, which corresponds to the Institute's aim of broadening and deepening evermore every field of inquiry, is able to meet the expectations of scholars",* with the explicit vision of what he envisioned, which introduced the concept of several users of statistics apart from the political decision-makers.

Combined with the work force survey of 1957, special research was also completed, published in 1958, "on some aspects of living conditions of the population". The survey indicates how the perspective of the social factor of official statistics was expanding. Furthermore, the focus on the education system and labour force, a priority until then, outlined the potentialities on which the political powers could count on in order to define development policies. Surveys that touched on individual choices and lifestyles outlined a first approach to the study of quality of life by looking into what people read, the use of new technologies of the time - radio, television, cinema - smoking habits, changes and aspirations of working fathers and sons, substantially the prospects for social mobility for themselves and for future generations. The fact that the respondent was the householder, who provided the information for all other components, consequently led to the fact that the variables used were only referred to the head of the family, from which the characteristics were also identified such as education and social profession. Such variables were interpreted as different variables of the behavior related to reading without taking into account how the higher diffusion of instruction in the younger generations could also modify the social habits of the whole family.

Yet combined with the labor force surveys of 1965 and 1973, the next two surveys were carried out specifically focused on the reading habits of individual members of the family in relation to newspapers, periodicals and books not read for purposes of study and work. The 1965 survey had already introduced more objective indicators of the breadwinner's declaration on the reading habits of the individual components. In fact, it detected the consistency of the library at home, attendance at public libraries, the

frequency of purchasing books and the expenditure for books, newspapers and magazines. The three surveys, repeated seven or eight years apart, foretell a new direction to build on in areas more closely related to social issues, not just demographic or economic, of the longitudinal paths, with reading being able to highlight and monitor the resulting changes of behaviors and lifestyles.
The censuses that fall in this period testify to the improvement in living conditions. In fact, the questions on housing conditions in 1951 are extended to also consider the presence of a heating system and, in 1961, also the type of system be it centralized or autonomous as well as specifying between services inside or outside the home (1951) and between the toilet and bathroom (1961): this ranges from measuring the satisfaction of needs to the level of comfort. In this light, beginning from 1971, the time taken to travel to the place of study or work, and the mode of transport is collected. In the 1961 and 1971 censuses, there is a section dedicated to the marital and reproductive life of women, which subsequently will not be replicated.

4. The push toward international comparable statistics and social indicators

Once again, a shock to the implementation and modernization of statistics comes from the cultural movements and international institutional arrangements of new supranational institutions. Social statistics in particular hold a new and stronger standing along with attention to which countries look to social inequality, belonging to social classes, lifestyle and marginality. The social indicator movement, born in the U.S. to meet the needs of the Central Administration of the country, had attracted the interest of all other Western countries, including Italy. In 1971 in Palermo the XXVII Scientific meeting of the Italian Society of Statistics, dedicated its work to social indicators. The scholars of the SIS, then as now, were mostly academics but the presence of members of ISTAT and central government, whose contributions would significantly change the perspective of the production of official statistics in the social field, was significant. An important event is the birth of the OCSE in 1960, an intermediate body between the UN and the EEC by number of countries involved, and its policy of integration and economic and financial cooperation between the most developed countries, which share a democratic political system and a market economic system. Such policy intensifies the pressure to produce statistics suitable to compare the political experience and living conditions of the member countries. Hence, on one hand the number and type of information required increases. On the other it poses a pressing need to examine the techniques and methodologies for collecting data to make it super nationally comparable. The quarterly surveys on the labour force had become fully operational. The yearbook of statistics on education was systematically published using administrative data implemented from time to time by special surveys such as the age distribution of the school population. It was published for the first time in 1976 and highlighted the different delays across regions during the academic years. From a thematic dimension other social issues present in the Italian Yearbook of Statistics become more detailed, as did collecting more administrative data. The systematic production is increasingly complemented by occasional surveys, often of a not periodic type, and referenced to specific social issues: the survey conducted on holidays every year since 1959, and the survey on sport.

But a more systematic reflection on social statistics appeared in the Second Conference on Information Statistics held in Rome in 1981, where an entire session was devoted to social statistics and which formed the basis for the publication of the second volume of social statistics - the first had already appeared in 1975. In the next volume of 1993 the title would change to "Social statistics and indicators". In the presentation G. Rey, the president at the time, clarified the choice, "*Without neglecting the absolute values, special attention was devoted to the preparation of reports and indices, which allow an immediate comparison between the configurations that individuals take in the various phenomena regions. To this end were used, where possible, coded and characteristic ratios now commonly used, while in other cases less common solutions have been proposed, notwithstanding the immediate preservation of the need for comprehensibility and relevance of the developed measures*. This approach represents a significant change in the role of official statistics in the direction of facilitating the interpretation of the information produced. The publication of these volumes has, as the main objective, providing a rich selection of statistical data relating to various aspects of social life, given in an overview. The last chapter introduced in 1993 wishes to represent a complete summing up of all the previous ones with the use of a little, yet essential, information in which some of the aspects, when taken together, help to define the socio-economic reality that goes by the name "standard of living". From this perspective certain aspects of household consumption are given more weight.

The contents of the three volumes of social statistics

SOCIAL STATISTICS - Volume I - 1975 Edition	**SOCIAL STATISTICS – volume II –1981 Edition**	**SOCIAL STATISTICS AND INDICATORS –1993 Edition**
Cap. 2 – Health Cap. 3 – Education Cap. 5 – Justice Cap. 7 – Household consumption Cap. 9 – Recreation and Culture Activities	Cap. 3 – Health Cap. 4 – Education Cap. 6 – Justice Cap. 8 – Leisure Cap. 9 – Income	Cap. 4 – Education Cap. 5 – Labour and Welfare Cap. 6 – Health and Justice Cap. 7 – Justice Cap. 8 – Culture and Leisure Cap. 9 – the standard of living

5. Household surveys

From this gradual growth of attention to social issues comes the 'Survey on family structures and behavior'. This was completed for the first time in 1983 in order to deepen the study of the family structure along with family relations and the system of free assistance.

This survey is a prerequisite to the Multipurpose Survey on families which kicks off the project in its earliest form in 1987 to complete the planned cycles, excluding the final that would never be realized in 1991. In this first round such a survey collected information on new family forms (such as free unions) and the life-cycle of women, with an emphasis on increased fertility and marriage histories. In addition the IMF, in its first version, included six six-monthly surveys, each of which noted a set of systematic and focused attention, from time to time, on specific issues and also envisaged, which was not realized, the choice of a sample type panel. The priority given to comparability over time and the possibility of integration of information was evident in this design. The IMF is a fixed point and totally innovative for social statistics in Italy. Firstly it was intended with the declared aim of summarizing in a single design, in order to detect all of the social issues of interest so as to be able to compare, both transverse and longitudinal, the social dimensions of people's living conditions and their transformation over time. This was achieved by monitoring changes themselves and in relation to changes that were occurring in other dimensions or within the family structure**.** It also extends those many areas of interest defined in the 1981 volume of the Social Statistics through the introduction, from time to time and in different cycles of: the victimization by crime, home accidents, conditions of disability, use of time, short-and long-term travel, school activities and conditions of childhood, the condition of the elderly, family networks, the use of social and health services and hospital use of medications, chronic diseases and smoking habits. All these issues are now dealt with by the individual and not on the part of the institutions. Hence by the demand rather than by the offer, completing the information of an administrative nature that might come from the school system, the health system, the social security system, the justice system, and so on. In this way, comparisons and differences were highlighted between statistics from administrative sources and the information provided by individuals. This is especially relevant when considering the uncertain number of unreported crimes, crime, domestic accidents that result in hospitalization or absence from work in health statistics, school dropouts not due to official withdrawal from courses, statistics, education, living conditions and care of the disabled, assistance and welfare statistics.

Between June 1988 and May 1989, the first national survey on the spending of ones time took place, indicating the different life styles and behavior in time management between different social subjects according to gender, age, family structure and so on. Taking the side of the individual also means following the path of detecting the subjective dimension. Thus the first questions in the questionnaires, in the form of direct perception and satisfaction. Thus a subjective and satisfaction approach which will increasingly be used in subsequent surveys by the IMF survey system. One example is the detection of the relationship between citizens and the public services in which aspects of subjective satisfaction and objective behaviors related to the operation are considered at the same time. The “pillar” survey of the current multi purpose system is on “Aspects of Daily Life”, conducted annually since 1993, when the system had been redesigned. It collects, in fact, all the phenomena which are then detailed in thematic research.

The survey "Citizens and leisure" was founded in 1995 as an attempt by Istat, to systematically describe a sector which is very tied to choices and subjective perceptions, such as leisure and relationships that exist between the latter and cultural participation.

The survey on public safety, also called on the victimization survey and carried out for the first time in 1997, takes the side of those who have suffered a crime, even if it has not been reported. The characteristics of the victims are, in so doing, put in evidence and the types of weaker subjects or those more easily attacked by specific crimes, emerge. In addition is the first survey in 2006 on violence against women in a framework of collaboration with the Department for equal opportunities.

Another international boost comes in relation to time use surveys that were conducted in several countries with different methodologies. In 1994 the SPC (Statistical Program Committee) proposed the harmonization of the Time Use surveys among Member States and, with the collaboration of all national statistical offices in Europe, were published in the 2000 guidelines which were subsequently updated in January 2009. In Italy the first survey along these lines was carried out from 1 April 2002 to March 31, 2003. The second survey from 1 February 2008 to January 31, 2009. The time use surveys provide a comprehensive and effective tool for delineating the lifestyles, conditioning, and behavioral choices of individuals with regard to age, gender and family structure.

Furthermore in 1998 the first survey "Family, social subjects and conditions of childhood" was conducted and repeated in 2003 with the same structure but with renovated and expanded content. In this survey, emergent phenomena such as prolonged permanence at home by young people in the family of origin and the postponement of marriage and reproductive projects by women, would be studied. There are new questions on subjective opinions, attitudes and intentions, foreseeing the key demographic trends and social attitudes towards family and work.
Within the context of "Family and social subjects" of 2003, the survey "the appraisal of career paths from a gender perspective" takes place in 2007. This survey was organized as a return survey on a subset of 10 000 respondents and allowed for a comparison between the perceptions and expectations raised in 2003 and the experience actually lived in the next three years: achievements, adaptations and responses to the events and concrete experiences. This is a way to objectify the levels of satisfaction and subjective perceptions.
An important social survey, created under an agreement between Istat and the Ministry of Labour and Social Policy, is on social integration of persons with disabilities through which the factors that hinder the full participation to economic life and social development of the country is analyzed. The survey, conducted between January and March 2004, was addressed to persons who were disabled or impaired in activity at the time of the survey "Health status and use of health services" in 1999/2000 and is therefore a further concrete example of integration and synergy between the various surveys of the system.
Another important survey to define the living conditions of households is on consumption, conducted annually since the late sixties (formerly sporadic surveys were carried out but exceptionally) undergoing various renovations and changes periodically over the subsequent years until finally completed in 1997. This survey, although falling within conceptual economic statistics, highlights the different lifestyles and monitors changes in dietary and spending behavior according to family structure and class. The information on household consumption over time become an information base for the work of the commission of inquiry on poverty6 and to define the poverty line in Italy in both absolute and relative terms. Contrary to other countries, Italy made the choice to calculate the relative poverty line based on household spending instead of income7. Then, in 2005, by making use of information resulting from the survey on household consumption, in particular on the expenditure structure and the distribution of durable goods, a line of absolute poverty through a basket of goods considered to be representative of the need of families, began to be calculated. This approach marks the final introduction of complex indicators into official social statistics.

6. The role of SISTAN within the change in approach to Social Statistics

The IMF experiences and finally finds its final structure during another event that led to a radical review of the Italian statistical system: the establishment of Sistan in 1989. This event defines the process of transformation of ISTAT into a research institution and this step will bring about a number of consequences including, importantly, the effort to provide users not only with data but also methods of analysis. From the new structure deriving from SISTAN, a set of tools and activities which reorganize the production of official statistics in the field of social statistics took place, with the social statistics sector gaining evermore an advantage. The National Statistical Programme (PSN), established every three years, determines in advance the activities and research foreseen during such a period; enters the process of producing a range of institutional subjects to whom the responsibility for specific areas and surveys is delegated: a timetable for the return of the current statistics for the system of ad hoc surveys is defined; the biennial Conference of Statistics is established; the Annual Report on the situation of the country presented annually to the Council of Ministers is done. In particular the latter, precisely because it is annual, is presented as a means of monitoring the situation of the country in terms of social and economic trends but also as a tool to address the issues highlighted as the most significant economic issues that emerged during the year. The social dimension provides much food for thought, bringing out phenomena on which it is appropriate to focus the attention of politics. It is at this stage that the official social statistics go further than ever before with a view to systematically propose, next to absolute data or relative indexes, indicators that are both simple and complex, suitable to make more detailed information and instrumentally accessible.

The direct involvement and accountability of government institutions and activities in SISTAN releases Istat from the burden of a systematic series of surveys deriving from administrative tasks and assigned, from time to time, according to the PSN, to the competent institutions that take responsibility for making available and publishing objective data related to their institutional activities. Alongside the above mentioned, also specific research interests which produce further statistic information that is fully available to the users and interacting with those produced by other actors within the system, emerge. In particular, the surveys done in collaboration between Istat and Isfol, deepen social issues on work, on inequality in general, and on unemployment. The survey of the BI on Italian household budgets, carried out since the 60s, is completely redesigned to provide data integrity with the Istat survey on goods consumption.

With the birth of Sistan, the real activities of Istat research with special ad hoc surveys carried out on their own, or in conjunction with other ongoing activities of other institutions, expands. The integrated system of surveys on the education-work transition, which began as early as 1989 and aimed at the analysis of subsequent pathways to achieving the graduation of young people, who successfully conclude a course of post-compulsory study, is carried out every three years and after the third year after graduation, is part of the first type of research.

Over the years the system has gradually developed, including:

1) the survey on the employment of University graduates launched in 1989 and now in its seventh edition;

2) the survey on the employment of college graduates, the first held in 1999 in relation to 1996 university graduates and the second conducted in 2002 on graduates of 1999;

3) the survey on the paths of study and employment of secondary school leavers, carried out for the first time in 1998 on 1995 graduates and followed by three more editions (2001, 2004 and 2007).

The survey on separation and divorce, conducted yearly by ISTAT in the civil courts since 1969 for separations and divorces and from 1971for divorces and the survey on child custody belong to the second type. But today the substantial legislative changes, both in marriage break ups and child custody, make these surveys strongly explanatory of change in behaviours and attitudes toward value-pairs of the traditional family. The data is recorded with a procedural character and provides important information on the demo-social data: date and rite of marriages, spouses' characteristics (date and place of birth/residence, nationality, marital status, previous legal assistance, education,

employment status). Such elements are significant to study the situation of breaking the marital union and the socioeconomic context in which they occur. They also study the consequences of the procedure such as the economic measures and the custody of children. Another type of social investigation that relies on the collaboration with administrative tasks is related to applications for adoption. Such is the case of a recent survey conducted by ISTAT for the first time in 2003 at 29 juvenile courts through a questionnaire administered through the registries and given to all couples who applied for adoption, noting their socio-demographic characteristics, labour mobility and territorial aspects of daily life and leisure, family and social network, the composition of the family, the characteristics of the house, grounds and preferences. The social value that surveys of this type cover is evident.
The Invalsi activity, whose statistics on the learning of children at various levels of education should also be mentioned. It is both co-ordinated within the OCSE framework, the PISA project, and individually conducted along with being coordinated with the MIUR and it represents a wealth of information on the skills differentially acquired by sex, region, type of school and so on, making a significant contribution to the predictive analysis capabilities also on human capital formation.

7. The surveys on living conditions of families in Europe: EU-SILC and the new Istat social surveys recently implemented or being planned

Since 2005, Eurostat and the national statistical institutes of Europe, made available to scholars and policy-makers a broad range of information on living conditions of European households drawn from sample surveys and administrative sources. But the most comprehensive survey of European social content is the EU-SILC survey carried out under the European regulation in order to allow comparability between the data collected from the various member countries. What makes this survey particularly interesting is that it is fully designed to meet the needs of monitoring of the Lisbon strategy and already provides as output the Laeken11 indicators, calculated and compared. The current interest in Istat social activities is further evidenced by the new special surveys recently completed, or soon to be realized. Among the first to be considered is the first survey on "Income and living conditions of the foreign population resident in Italy" conducted on a sample of 6,000 families with at least one foreign member. This survey was also created at the initiative of another public institution, the Ministry of Labour and Social Affairs, and employed the same methodological tools used for the EU-SILC survey, collecting a whole series of similar socio-economic information to those available for the Italian population. The comparison may be helpful to understand the pathways to integration and the ways in which the new multi-ethnic society is forming which will be tomorrow's reality.
In the project phase, it is still the statistics of homeless people and those who don’t occupy a house which, despite the significant methodological difficulties of implementation, once completed, will highlight the emerging and up and coming phenomena such as new types of poverty and marginalization.

Turning the Compulsory Communication data into a statistical system

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Key words: Compulsory Communications, Administrative Data, Statistical Information System

Abstract The Compulsory Communications system is a stream of declarations due by employers to notify the events of activation, termination, extension, or transformation of each employment relationship. Thanks to its wide coverage and rich variable set, these data will provide an informative basis: a) to timely monitor the short term evolution of the labour market at a very detailed level and b) to perform complex analysis on the structure of labour demand and labour policies effectiveness. To fully exploit the potential of this administrative source a set of data editing and processing procedures have to be set up, in order to construct and update information on complex statistical units such as employment relationships (jobs). This paper illustrates the building blocks of the current procedure flow and their statistical impact.

1 Relevance, scope and objectives of the Statistical Compulsory Communication system

The Compulsory Communications system (*Comunicazioni Obbligatorie,* from now on CO), managed by the Ministry of labour and social policy[2], is a stream of declarations

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due by employers to notify the events of activation, termination, extension, or transformation of each employment relationship. The administrative data thus generated cover all sectors of the economy and, with very few exceptions, all persons engaged in a relationship characterized by a work contract. A very distinctive feature of the system, compared with most other administrative sources, is that it allows to measure only flows in and out of employment and not stocks of jobs or persons. However, the difference between the number of activations and terminations measures the net change in the stock of jobs, much like the change in employment produced through the labour force survey. The communications contain a rich set of variable of the employer (economic activity, workplaces, etc…), of the worker (gender, age, education, citizenship, etc.…) and of the job (occupation, type of contract, type of working time, etc. …). A statistical system based on this administrative source might greatly enhance the informative support to policy making and analysis, through two broad classes of uses. A) Short term evolution of the labour market monitoring. Since the communication flows into the local and national databases in real time, these indicators can be released very timely. In addition to indicators on the number of activations and terminations (and their difference), statistics on the transformation into permanent jobs, the duration of labour contracts, the cause of termination (voluntary and involuntary) are able to provide a rich picture on the labour market dynamic. Since the system measures all the events happened in the economy, this representation can be very detailed in all the relevant dimensions (geographical, sectorial, characteristics of workers and job). B) Studies on labour market policies and on the composition of the labour demand. The availability of (longitudinal) microdata opens the possibility to answer a number of questions relevant to policy makers and analysts. Examples are: what is the probability of an agency worker (or other type of temporary worker) to get a permanent job in a certain lapse of time? Are the subsidies devoted to the occupability of person with disabilities effective? Which are the occupations most requested by enterprises? The following paragraphs illustrate the building blocks of the procedure flow necessary to turn the administrative data into a statistical system able to respond to the wide range of uses above described.

2 Data acquisition and processing

Since March 2008 more than 70 millions communications have uninterruptedly flown into the national database. As it is common with administrative data the phases of acquisition and pre-processing of data are not designed and implemented to produce statistics and have to be taken as they are by the statistician[3]. However, they have to be monitored and the description of the procedure flow must start from this very first stage, having a considerable impact on statistical results. Most of CO data are acquired via web applications set up at local level. Although they should follow a unique, centrally defined, set of standards, not all the implemented applications are totally compliant with them. Moreover, a part of data is acquired through: massive sending, aimed at facilitating the simultaneous delivery of a large number of communications; *ex*

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[2] See reference [5].

[3] See references [3], [4].

officio communications resulting from inspections; and a specific route for the domestic work. The heterogeneity of the data capturing tools can introduce several types of errors and, as a result of the different time lags of data arrivals into the system, can also affect the data consolidation process[4].

Each communication entering the System is stored as a XML file in a Repository. Then, the information is organized in an *Administrative DataBase* where each communication is classified on the basis of type of the module used and identified through a key composed by the CO code, the worker ID and the CO sending date.

From there, exclusion procedures are applied to get rid of those communications for which a cancellation or correction has been received. The quality of the key used to combine the original communication with the corresponding cancellation or correction determines the success of this step. In the following phase CO data are processed and organized in a *Database of Transactions*. Each transaction represents a single event of activation, termination, extension, or transformation of an employment relationship and is identified by a threefold key composed of: employer ID, worker ID and employment relationship starting date. The final segment of the procedure flow aims to produce the *Statistical Database*. Two intertwined classes of procedures operate in this step. A first class aims to check and edit the variables associated with the employer, the worker and the job. Each variable modality is checked against the standard dictionaries and classifications in order to identify coding errors and non-responses. The second class of procedures aims to reconstruct the main unit of the statistical database, the job, defined as an employment relationship between an employer and a worker and characterized by the relationship starting date. The jobs are built by linking sequentially the transaction of activation to the other types of transactions (extension, termination and transformation) referred to the same relationship, identified by the threefold key. This is the end point of the process from which the analysis on microdata or the aggregate indicators can be produced.

This last step of the process is very delicate as more records are recombined through record linkage procedures: the quality of the threefold key is a prerequisite for the reconstruction of statistical information. Moving to the statistical database, a transaction can be discarded not only due to errors in the threefold key, but also as a consequence of violation of consistency rules within the same communication and/or between different communications related to the same job. In particular, for a new job to be created or for an already existing one to be updated, the transactions have to pass some edit rules. These can be classified into three groups: rules on the quality of the threefold key; rules regarding the inclusion of the jobs with respect to the CO system constitution date (1th march 2008); and rules on the job end date. With respect to the first group, it is imposed that the key variables can be used only if they have passed the edit rules (before or after an imputation). If one of the three key variables is affected by errors, a transaction is not matched with the correct job and the chain of events related to it is interrupted[5]. This can result in biased estimates of the target quantities (the number of activations, terminations, the job duration, etc.), either in the case that such transaction is discarded or in the case in which, assuming that the transaction(s) constituting the base job is(are) missing, a new job is created starting from the information contained in the transaction itself. For instance, suppose that an extension of a temporary job is not merged with the corresponding activation. If the transaction is

[4] Consolidation aspects are described in reference [1].

[5] See reference [2].

discarded, the number of terminations in the period when the job contract was supposed to end will be overestimated and the average duration of the jobs will be underestimated. If, instead, the transaction is kept and a new job is created using the information of the beginning date contained in the extension itself, the job is duplicated, the number of activation and terminations will be overestimated and the duration of jobs, as an average between the first job and the newly created one, is underestimated. The duplication of jobs has also a negative impact on the CO data stabilization process contributing to make it longer, since it introduces a considerable lag between the date when the event occurred and that of its recording into the CO system. With respect to the second group of rules, it is established that a job with a beginning date after the 1th march 2008 can be created only by a activation communication. Stemming from the legal obligation this rule avoids to create new jobs from communications other than activations with the risk of duplications. The third group of rules aims at making the end date consistent with the type of contract reported in the activation communication or with any subsequent extension or transformation, avoiding misalignments of the dates. The violation of the last two group rules can also implies inaccurate measures of the target quantities and a longer data consolidation process.

3 Conclusions and future developments

In this paper we illustrate the main steps of the CO data processing, starting from the administrative declarations and ending with the construction of the complex statistical unit “job”, discussing which problems can arise in the procedure flow and their statistical impact. While the structure of the entire process is already in place, some procedures are going to be refined and others set up. Four main areas of work are under development or will be started in the near future: the check and editing procedure of the threefold key, the design of consistency rules for the non key variables, the integration of external sources either to edit variables or to add information to the system, the design of a set of indicators to monitor the quality of the process and to signal anomalies when they occur.

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The Nonprofit Sector in Italy: scope and remit

Andrea Bassi, Franco Lorenzini, Stefania Della Queva, Manuela Nicosia

Abstract The nonprofit sector's statistics do not provide a complete picture due to critical issues, such as a wide range of organizations and activities. For this reason, the National Institute of Statistics adopted the International Classification of Nonprofit Organizations (ICNPO) developed by the Centre for Civil Society of the Johns Hopkins University in Baltimore (USA) that ensures the cross-national comparison of data. Nevertheless, a contextualized analysis is needed in order to understand adequately the sector at national level.
Starting from the ICNPO and the analysis of services provided by Italian nonprofit organizations, the overall objective of the paper is to explore the weaknesses and to propose a classification of Nonprofit activities enable to represent the main features of Italian framework. The empirical part has been developed through the data analysis of voluntary organizations available in Istat.

Keywords: Nonprofit sector, ICNPO, cross-national comparison, services

1 Introduction and Methodological Approach

The ICNPO (*International Classification of Nonprofit Organizations*) [1] has been developed in partnership with the Johns Hopkins University Center for Civil Society Studies and the Economic Statistics Branch of the United Nations Statistics Division.

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Based on ISIC[1], it is applied on several cross-national comparison studies on nonprofit organizations. Adopted by Istat, ICNPO is the framework for analysing nonprofit sector. The classification system is composed by 12 categories[2] divided into 27 sub-categories. Although it adequately fits with the Italian context, it does not allow to fully catch the features of Italian non-profit sector.
The paper explores Italian Nonprofit sector in terms of provided activities and services, through applying Multiple Correspondence Analysis and Cluster Analysis on data from Voluntary Organizations Survey [3].

2 Results

Voluntary Organizations[3], within Nonprofit sector, represent a set of different entities, have been considered to analyse the provided services. The MCA analysis explored five dimensions (Factors[4]) identifying specific aspects of voluntary organizations. The first one regards the beneficiaries of services, the individual and the environment, while the other factors describe the activities. The second one concerns civil protection role linked to environmental purpose. The third dimension considers on an hand the health care and welfare services, and the offer of leisure services, on the other hand. The forth factor includes the ambivalent structure of voluntary organizations taking into account the dynamic dimension including international cooperation activities, crossing national border. The last dimension regards the type of users, both the most vulnerable population (sick, elderly and people with disability) and general public.
A Cluster Analysis[5] has been applied to the MCA results, which identified 9 groups of services (Fig.1).
It showed that the civil protection takes up initiatives mainly in two sectors: environmental sector and citizens' safety.

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[1] International Standard Industrial Classification of All Economic Activities

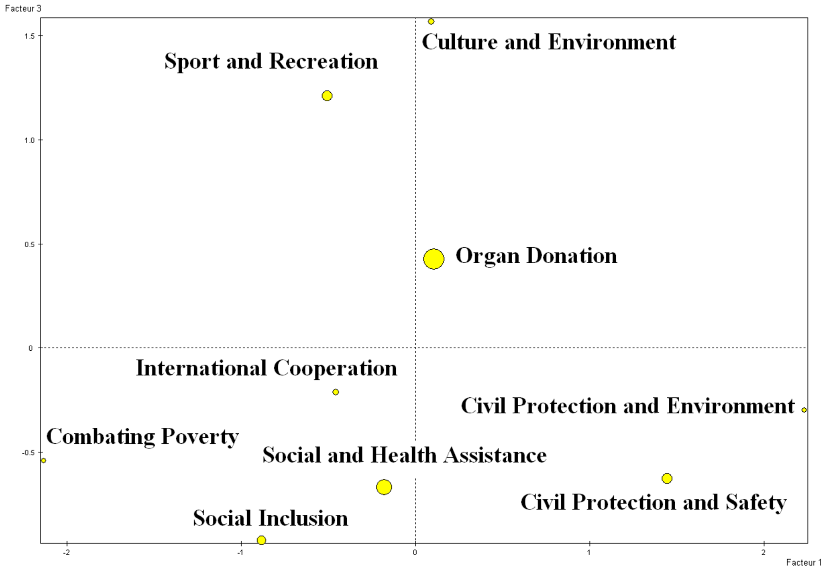
[2] 1) Culture and recreation, 2) Education and research, 3) Health, 4) Social services, 5) Environment, 6) Development and housing, 7) Law, Advocacy and politics, 8) Philanthropic intermediaries and voluntarism promotion, 9) International, 10) Religion, 11) Business and professional associations, unions, 12) Not elsewhere classified.

[3] The analysis involves 10.193 organizations, selected among those ones offering more than one service (the sample counts 21.485 units, which resulted active, besides those ceased, suspended, not subscribed and duplicated)

[4] Explaining the 26% of total inertia

[5] The procedure uses a mix algorithm for clustering (hierarchical with Ward's method and partitional)

Figure 1: MCA and Cluster Analysis, by Services of Voluntary Organizations, Italy, 2003



Source: data processing on ISTAT - Voluntary Organizations, Italy, 2003.

The "Social services" category, prominent among the voluntary organizations, showed three different sub-categories. The first one related to "health and social purposes", provides homecare services, emergency and relief services, health care services, targeted to users with specific needs, such as non-independent people, elderly and terminally ills. The second one includes poverty reduction, providing food, clothing, shelter, income support to targeted people such as nomads and homeless. The last sub-category of social services is aimed to satisfy individual needs by providing victims of crimes, violence and natural disasters with self-help and personal counseling, legal and advice services.

Two groups emerge from the integration between cultural and environmental services, and sportive and entertainment services.

The international cooperation related to philanthropy activities (fundraising, clothes and medicines collection) represents the humanitarian dimension.

The organ and blood donation is another niche of voluntary activity.

In order to verify the correspondence between clusters and ICNPO classification, Table 1 shows the categories distribution by each group (% row), outlining what emerged from the analysis in terms of sub-categories, such as the civil protection, social assistance and international cooperation.

Table 1: *Cluster Groups by the ICNPO Categories (% row)*

Cluster Groups	**Culture**	**Sport**	**Recreation**	**Education and Research**	**Health**	**Social services**	**Civil Protection**	**Environment**	**Development and housing**	**Law, advocacy and politics**	**intermediaries and voluntarism promotion**	**International**	**Religion**	**Total**
Civil Protection and Safety	0,1	0,4	0,1	0,0	23,9	2,5	70,0	2,9	0,0	0,0	0,1	0,0	0,0	100
Civil Protection and Environment	0,6	1,1	0,0	0,0	3,2	0,9	78,6	15,4	0,2	0,0	0,0	0,0	0,0	100
Humanitarian activities	3,9	0,0	2,8	1,7	10,2	20,6	0,5	0,8	0,3	1,1	6,7	49,5	1,9	100
Culture and Environment	38,0	2,9	11,5	9,2	1,8	4,8	2,2	26,5	0,2	1,5	1,1	0,3	0,0	100
Leisure	7,0	13,0	32,8	3,2	9,8	30,2	0,4	0,7	0,2	0,6	0,9	0,3	0,9	100
Organ donation	14,7	2,8	9,5	5,4	32,7	14,7	2,2	4,6	0,4	2,4	6,9	3,1	0,5	100
Social and health Assistance	0,1	0,0	2,3	0,5	27,5	67,5	0,2	0,1	0,0	0,7	0,5	0,2	0,4	100
Combating poverty	4,8	0,7	8,1	1,9	7,1	67,2	0,2	0,5	0,7	2,4	3,1	1,9	1,4	100
Social Inclusion	1,1	0,1	1,3	2,5	5,6	67,5	0,0	0,6	0,4	18,6	1,9	0,2	0,2	100
Total	7,6	2,6	8,1	2,9	19,3	32,0	12,6	4,1	0,2	3,1	2,8	4,1	0,5	100

Source: data processing on ISTAT - Voluntary Organizations, Italy, 2003.

3 Conclusions

According to organizations' service data, the so-called supervisioned classification above-described aimed at defining a better and transparent analysis of voluntary organizations' activities that, in the context of Nonprofit institutions, has been carried out in different areas in order to respond to various needs. With regards to the forthcoming activity classification, these evidences might be taken into consideration, underlining procedures aiming to verify sensitivity and specificity of defined categories.

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Water use for irrigation purpose in agriculture: the integration of a modelling approach and the Sixth Agriculture Census survey

Giampaola Bellini, Flavio Lupia and De Santis Francesco1

Abstract Irrigation represents in Italy one of the most relevant pressures on environment in terms of use of water as in other Mediterranean countries where hot and dry season might require additional water for the optimal growth of specific crops. To monitor the phenomenon several data have been collected by Istat during years through Farm structure. Nevertheless only poor data on water consumption are available at national level; in fact a settled methodology has not been available so far and surveys don't represent the proper statistical tool to acquire direct information on the amount of water used for irrigation. *MARSALa* (*Modelling Approach for irrigation wateR eStimation at fArm Level*) project was realized in the framework of the Eurostat Grant Programme 2008 (Theme "*Pilot studies for estimating the volume of water used for irrigation*")[2] by the National Institute of Agricultural Economics (INEA) [1]. Istat cooperated and contributed to the implementation of the project since the beginning in several phases. Aim of the project was to design a methodology for the estimation of the irrigation water consumption at farm level in Italy by using, as a key source of information, the 6th General Agricultural Census 2010.

1 Irrigation practice in Italy

Despite relevance of irrigation practice in Italy, data available on volume of water used for irrigation purpose are quite poor. It is only roughly known that around 20 10^9 cubic

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[2] Grant Agreement No. 40701.2008.001008.140. http://circa.europa.eu/Members/irc/dsis/agrienv/library?l=/consumption_irrigation/consumption_irrigation&vm=detailed&sb=Title

meters – representing around 50% of total use of water for human activities are abstracted for irrigation [3].

The irrigation monitoring activity has been performed by Istat by collecting several data during years through Farm Structure Survey (FSS) - at census and sample level - as required by European regulations and for national interest [2]. At national level the following data are available: farms with irrigation activity, irrigable and irrigated surface, irrigated crops, irrigation system adopted and related irrigated area, source of water and supply methods. In the following scheme it is possible to see that data collected at national level (IT code) have been diverse over time compared to the ones defined at European level (EU code).

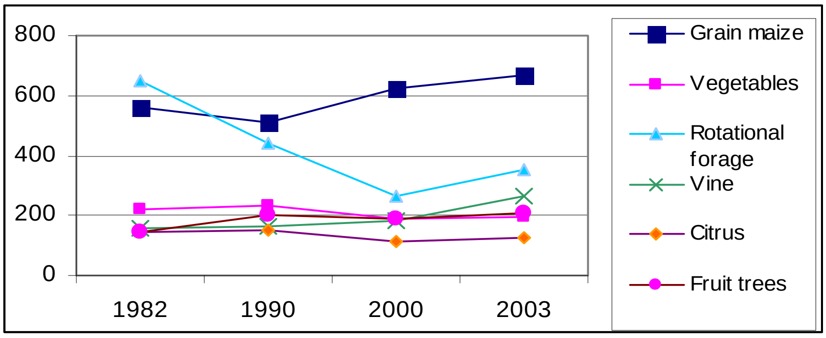
Scheme 1 – Irrigation variables available at national level by year

VARIABLES (unit of measure)	2000	2003	2005	2007	FSS 2010 and beyond	SAPM 2010
Irrigable area (ha)	EU	EU	EU	EU	EU	-
Irrigated area (ha)	EU	EU	EU	EU	EU	-
Irrigation system	IT (ha)	EU(Y/N)	IT (ha)	IT(ha)	IT (ha)	EU(Y/N)
Irrigated crops (ha)	EU	EU	-	-	IT	EU
Supply source (n. of h.)	IT(Y/N)	EU	-	-	IT	EU

The information on irrigation practice is collected being one of the characteristics required by the Survey on Agriculture Production Methods[3] (SAPM). It has to be stressed that in Italy the information will be available for any holding, as the survey is carried out at census level and not on a sample basis, as defined by Regulation.

Referring to the phenomenon trend, recourse to irrigation practice at farm level didn't increase that much over time at farm level moving from 2,521,193 ha irrigated in year 1982 to 2,666,205 ha in year 2007. What changed quite a lot is the area of the irrigated crops as showed in the Figure below.

Figure 1 – Irrigated area by crop type (000 ha) – Year 2003



[3] Reg.(EC) n. 1166/2008 on farm structure surveys and the survey on agricultural production methods and repealing Council Regulation (EEC) No 571/88

2 The methodology

The methodology grounds on the development and integration of three models dealing with the main aspects related to the farm irrigation water consumption: the crops irrigation demand (Model A), the irrigation systems efficiency (Model B) and the farmer's irrigation strategy (Model C). Each model was developed by considering state-of-the-art methodologies as well as the available datasets (climate, soil, crops characteristics and statistics) in Italy, the expert knowledge and the nature of the information collected by the Census.
The three models are implemented through a software application called *MARSALa.NET* was developed to estimate the farms irrigation consumption by the integration of the three mentioned models.. *MARSALa.NET* has a client-server architecture and has several routines for pre-processing the required data from the Census results as well as a built-in set of databases about crop phenology, soil characteristics and agro-meteorology.

3 Estimation of the crop water requirement

Based on this basic model's requirements the Census questionnaire[4] has been integrated on the irrigation section in order to get the most appropriate variables.
The estimation of the irrigation water consumption will be available for each agricultural holding with the irrigation practice.
The integration of questions refers to:
- question 22.4 *Crops irrigated almost once in the agrarian year 2009-2010*, where the main irrigation method used is required per each crop: 1) Superficial flowing water and infiltration; 2) Flood; 3) Aspersion; 4) Micro-irrigation; 5) Other system;
- question 22.7, inclusion of a question relative to the use of irrigation advisory services and/or systems for determining the crop irrigation demand;
- question 22.6 *Irrigation water source supply* codes 04 and 05, insertion of two questions about the type of delivery of irrigation water: i) delivery arranged by rotational turns; ii) delivery on-demand. These information feed Model C being strictly connected with the irrigation strategy of the farm.

To assess whether asking the irrigation system by crop type in question 22.4 would have introduced a bias an elaboration was made on 2007 FSS data to better understand the distribution of the irrigation system adopted at farm level, an analysis has been performed showing that 76% of the irrigated area is in farms adopting only one irrigation system, 22.1% in farms with two different irrigation systems, whereas only 1.9% is irrigated in farms with three and more irrigation systems.
The complete information derived from the questionnaire refers to: irrigated areas by crop type, irrigation system by crop type and related area, geographical localization (municipality level), type of delivery of irrigation, , irrigation water source and use of irrigation advisory services. The estimation will be performed by using the software MARSALa.NET by setting appropriately the input data required coming from the

[4] Questionnaire of the Sixth General Agriculture Census. Available at http://www.istat.it/censimenti/agricoltura2010/questionario.pdf

Census and the software built-in databases. Census data must be necessarily pre-processed to be used for the estimation, for example irrigated crop categories have to be split into specific irrigated crops combining irrigated area with farm land use (collected through Section II of the questionnaire). Different rules have been defined depending on crops involved. The easiest case occurs when the same crop category is mentioned in question 22 *Irrigated crops* and in Section II for questions from *Arable Land* to the *Utilised Agricultural Area* (UAA), potato and rice are two of those cases. The second typology is when a category in question 22 is split into several crops in Section II, as it is the case for Vineyards and the Other permanent crops. In those cases a priority for irrigated area is given to the cultivated area not yet in production and the remaining is attributed to the other possible cultivations according to the relative incidence over the total. Whether crop category declared in Section II is still undefined, as it is for vegetables, those data will be combined with information on vegetables cultivated in the province as arise from the annual Istat survey on crop surface and harvest, according to the weight of each crop on the total vegetables cultivated at provincial level. Then again the value of the irrigated area will be attributed to each specific component.
Moreover data on irrigation and specific crops are collected per farm and whether farms are spread on different municipalities data collected through Section IV - location of holding crops and livestock has to be processed also. Also in this case rules have been defined and an estimation has to be performed to derive the irrigated crop area by municipality.

4 Conclusion

The estimation of the water consumed for irrigation purpose is of paramount importance for our country. The methodology defined has the strength of being related to the variables collected through the General Agricultural Census and this will make possible to elaborate the same estimation also in the future, whether the input variables will be collected and the data set on which the model is realised will be updated over time.
Nevertheless the survival of this project in the future is also linked to the adoption of the best practice among different institution at national level as several data producers are involved. Particularly it has to be stressed that the part requiring more attention is the territorial detail of the meteorological data set.

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Sixth General Agricultural Census: information needs on rural development and pressures generated by agricultural activity on the environment

Giampaola Bellini, Paola Giordano and Eleonora Di Cristofaro[1]

Abstract In the last decades the Italian agriculture has experienced profound changes due mainly to the EU policies. Particularly, the structure and role of National agricultural holdings has changed in relation with policies implemented to promote rural development, the environment pollution and depletion prevention. European Union, the scientific community and the public opinion require new statistical data to monitor the adoption and the effect of policies on natural resources management and protection. The statistical tool that seems to be particularly suitable to collect information on some specific phenomena is the farm structure survey, and the one implemented in year 2010 represents the census version. More precisely, the new content of the Sixth General Agricultural Census questionnaire[2] refers to pressures generated by agricultural activity, depending on how agricultural practices are realised and livestock is managed and raised. Such pressures create effects on environmental media (air, water and soil) and biodiversity. The main objective of this work is to give an overview on new census variables and their use to calculate Agri-Environmental (AEI) and Rural Development Indicators (RDI) defined at international and national level.

Keywords: agricultural census, pressures, agri-environmental indicators.

1 Background

The Sixth General Agricultural Census, run in year 2010, is mandatory and required by Reg. (EC) n. 1166/2008 that refers to the institution of a statistical framework in order to compare statistical data on farm structure and on agricultural production methods. The latter represents the most important challenge of this census and has had a great impact in the implementation of the Census questionnaire. This regulation meets the needs of data collection on the implementation of measures associated with rural development, as defined in the Reg. (EC) n.

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[2] Questionnaire of the Sixth General Agriculture Census
http://www.istat.it/censimenti/agricoltura2010/questionario.pdf

1698/2005 on rural development support by the European Agricultural Fund for Rural Development (EAFRD). Moreover, Reg. (EC) n. 1166/2008 takes into account the implementation process of indicators for agri-environmental phenomena description. The process was launched in year 2001 through the implementation of the Irena project (*Indicator Reporting on the integration of ENvironmental concerns into Agriculture policy*) and lead by the European Environmental Agency, involving member states through Eurostat Working Groups. This project ended with the Com. (2006) 508 adopted by the EC, in which 28 agri-environmental indicators and their potential data sources where identified and described, with particular reference to farm management practices and the use of farm inputs. The definition of such frame is an intriguing challenge, if one has in mind that all the phenomena encountered are related to several policies targeting farming activity such as: i) United Nations Framework Convention on Climate Change (UNFCCC); ii) Rural Development Programme (RDP); iii) Land-use, Land-use Change and Forestry (LULUCF); iv) Water Framework Directive (WFD); v) Nitrates Directive (ND); vi) National Emissions Ceiling Directive (NECD); vii) Framework Directive on the Sustainable Use of Pesticides; viii) Birds & Habitat Directive (NATURA 2000).

The improvements on the collection of information on agricultural production methods linked to structural information on agricultural holdings provide additional statistics for the development of agri-environmental policies and for the advancement of the quality of AEI. This possibly would help in achieving comparable data on agricultural activities covering the whole Community at the appropriate geographical level.

2 FSS and SAPM data collection for AEI/RDI calculation

The development of indicators includes both the simple dissemination of validated data (in the case of simple indicators) and the integration of validated data into further calculations (in the case of complex indicators).
Part of the data collected through Agricultural Census (AC) can contribute to the calculation of the following AEI (Table 1).

Table 1 – AEI indicators implemented through FSS and SAPM data collection

INDICATOR		Description
1	**Agri-Environmental commitments**	Share of agricultural holdings with agri-environmental commitments/total number of agricultural holdings
3	**Use of environmental farm advisory services and farmers' training level**	Percentage of farmers having only practical experience
		Percentage of farmers having basic training
		Percentage of farmers having full agricultural training
		Percentage of farmers having made use of environmental farm advisory services per year
4	**Area under organic farming**	Area under organic farming
		Share of areas under organic farming per total utilised agricultural area

Table 1 – AEI indicators implemented through FSS and SAPM data collection

7	**Irrigation**	Irrigable area
		Irrigable area per total utilised agricultural area
		Irrigated area
		Irrigated area per total utilised agricultural area
		Irrigated crops (10 + tot)
		Irrigated area per type of irrigation
10,1	**Cropping patterns**	Area occupied by the major agricultural land types
		Share of agricultural land types per total utilised agricultural area
10,2	**Livestock patterns**	Number of major livestock types (cattle, sheep, goats, pigs and poultry)
		Share of major livestock types
		Livestock density index (livestock units per utilised agricultural area)
		Grazing stocking rate: livestock units of cattle, sheep and goats per grassland and forage crops
11,1	**Soil cover**	Days of the year when the arable area is covered by plants or plant residues
11,2	**Tillage practices**	Area managed by conservation tillage (low tillage)
		Area managed by zero tillage (direct seeding)
		Area managed by conventional tillage
11,3	**Manure storage**	Type of storage for farm manure and slurry
13	**Specialisation**	Utilised agricultural area managed by different farm types
		Share of specialised farms by type
14	**Risk of land abandonment**	Index of risk abandonment
15	**Gross nitrogen balance**	Gross Nitrogen Balance
17	**Pesticide risk**	Pesticide risk index
24	**Production of renewable energy**	Area of energy crops by type
28	**Landscape -State and diversity**	Impact of farming practices on landscape
		Landscape structure

At a national level, a challenging decision was taken to survey any characteristics included in the Farm Structure Survey (FSS) and in the Survey on Agricultural Production Methods (SAPM) through a unique census questionnaire. This means that data will be available for any agricultural holding going beyond Eurostat requirements as Reg. (EC) n. 1166/2008 requires data for SAPM only for a sample of holdings statistically representative at the level of NUTS 2 regions. In addition, the Regulation mentioned above requires the location - at a point level - of the place where main part of the production is realised (avoiding the direct identification of an individual holding). Hence, it is possible to exploit this data source integrating it with others and performing analysis at a very detailed territorial level of – among others - the surveyed phenomena.

Furthermore, since Istat has a long experience on data collection on agricultural practices, some definitions have been adapted in order to create consistent time series and to calculate AEI of national interest.
In the stakeholders' consultation process (the process implemented for the participation of interested parties in the decisions by providing needed information), the Institute for Environmental Protection and Research (Ispra) – among others – has given its contribution to get more detailed information on phenomena related to livestock grazing and stable conditions. In doing so, more accurate estimates will be available to implement the national emissions inventory[3].
It is worth noting that data on irrigation phenomenon turn also to be useful for the estimation of water used for irrigation at farm level – as required by Regulation defining SAPM characteristics. This provides supporting arguments for the calculation of AEI 20 "Water abstraction".
The information on holding benefiting of agri-environmental payments received by farmers has been collected for national interest, in order to calculate AEI 1 "Agri-Environmental commitments".
As regard to Rural Development (RD), a whole section of the FSS questionnaire has been devoted to the collection of information on whether or not the holding has benefited from some specific RD measures during the last three years according to certain set standards and rules specified in Regulation (EC) n. 1698/2005. This decision has to be taken, because of the delay in availability of administrative data set for quality assessment purpose to be run by Istat.

3 Conclusions

The paper makes evidence of the fact that information collected through AC is of paramount importance for describing agri-environmental phenomena. The full exploitation of this data source is possible by performing a proper projecting and planning of the data dissemination.

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An attempt to identify homogeneous and spatially contiguous areas with regard to the main features of usually resident foreign population in Italy

Federico Benassi, Raffaele Ferrara[1]

Abstract Considering the main features of usually resident foreign population, the aim of this paper is the identification of homogeneous and spatially contiguous areas intermediate between the provincial and the national levels. Statistical indicators on usually resident foreign population computed on official data provided by the Italian Institute of Statistics (Istat) have been used as the input of a spatial clustering and regionalization method (Guo, 2008) in order to get a classification of the Italian provinces into a number of homogeneous and spatially contiguous areas. Given the progressive decentralization of governance activities, this application represents a very interesting case of study. In fact the identification of new spatial areas built on the basis of both the characteristics of the usually resident foreign population and the spatial dimension of the territory where this population lives could become a useful tool for local governance. Furthermore in the very next future the proposed method could be applied at more detailed territorial levels (e.g. Census Enumeration Areas).

Key words: migration, spatial data analysis, regionalization

1 Introduction

It's well know that foreign presence in Italy has significantly grown in the recent past: in 2001 the census recorded 1.3 millions of usually resident foreign population, today,

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official data provided by Istat certify that usually resident foreign population is over 4 millions, 7% of the total population usually resident in Italy. Foreign population is characterized by a great level of heterogeneity in terms of country of origin, demographic structure, migratory projects, activity status, geographical distribution. This complexity is reflected at all national territorial levels and has important repercussions and implications on a great number of matters. It is not a case that immigrants have become a central issue of the Italian political debate. Considering the main features of usually resident foreign population, the aim of this paper is the identification of homogeneous and spatially contiguous areas intermediate between the provincial and the national levels.

2 Data and method

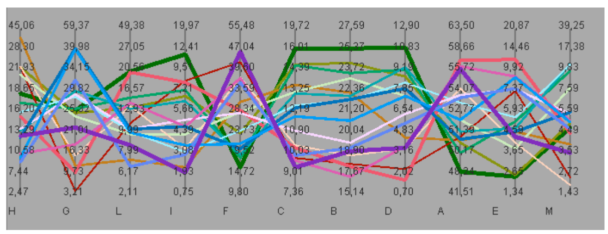
In order to obtain spatial contiguous areas we applied a spatial clustering and regionalization method called RedCap (Guo, 2008). According to Guo (2008) we define regionalization as a process that divides a large set of spatial objects into a number of spatially contiguous regions while optimizing an objective function, which is normally a homogeneity (or heterogeneity) measure of derived regions. Therefore regionalization is a special kind of spatial clustering where the condition of spatial contiguity among spatial objects plays a priority role. RedCap is essentially based on a group of six methods of regionalization which are composed by the combination of three agglomerative clustering methods (Single Linkage Clustering, SLK; Average Linkage Clustering, AVG; Complete Linkage Clustering, CLK) and two different spatial constraining strategies: First-Order constraining and Full-Order constraining. We refer to the work of Guo et al. (2005); Guo (2008) for technical and computational details about these six methods of regionalization. Considering the aim of this paper, we select as input variables some statistical indicators referring to demographic and migratory dimensions of the foreign population for each province. The statistical indicators, computed on 2010 date provided by Istat, are: 1) % proportion of female usually resident foreign population (A); 2) % proportion of usually resident foreign population < 18 years old (B); 3) % proportion of usually resident foreigners born in Italy (C); 4) % proportion of usually resident foreign population (D); 5) % proportion of usually resident foreign population coming from More Developed Countries (E), from Central and Eastern European Countries belonging to UE (F), from Central and Eastern European Countries not belonging to UE (G), from North Africa (H), from the Rest of Africa (I), from Asia (L), from Latin America (M). These statistical indicators are been recently used in this kind of analysis (Benassi, Ferrara, Strozza, 2010).

3 Application and Results

Firstly, an explorative analysis based on the results of the SOM (Self-Organizing Maps) algorithms implemented in RedCap is carried out. We can then identify groups of clusters similar to each other on the basis of the results of a clustering process, visualized on the unified distance matrix, not taking into account the condition of spatial contiguity. 16 clusters are thus identified, out of the 107 provinces, defined by the node hexagons on the SOM (Fig. 1 (b)).

(a) Multivariate mapping

(b) Clustering with SOM



(c) Multivariate visualization of clusters (Parallel Coordinate Plot)

Figure 1: General results (without constraining strategy).

Territorial units with the same colour belong to the same cluster and clusters with similar colours have a low level of dissimilarity. The level of similarity is measured and visualized by the Parallel Coordinate Plot (PCP) (Fig. 1 (c)). In this plot we can observe the profile of each cluster. In more detail, we can see eleven parallel axes (one for each indicator) scaled by a nested means method (Guo et al., 2005). The profile of each segment (that is to say of each cluster) has to be compared to the central value of each axe that is the value of that indicator computed for the total area. In Fig. 1 we can clearly note some areas with great level of similarity both in terms of statistical indicators and of spatial attributes (especially green, violet and pink areas). Following to this explorative analysis, we have applied the Complete Linkage Clustering Method together with a Full Order constraining strategy (CLK-Full Order) in order to obtain *n* areas that, given the condition of spatial contiguity, minimize the inner heterogeneity as to the main features of usually resident foreign population. We identify 9 areas: 3 with high level of inner homogeneity, 4 with a medium level of homogeneity and 2 with low level of homogeneity. To be brief we show only the 3 areas with high level of inner homogeneity. These areas are very interesting because they represent three different patterns of migration.

(A) (B) (C)

Figure 2: Three regions with high level of inner homogeneity.

Area (A) represents the traditional migration, typically labour dominant. In fact it is characterized by a high % proportion of usually resident foreign population, a high % proportion of usually resident foreign population coming from Africa and Asia, a balanced gender structure and high % proportion of usually resident foreign population age <18 years old and of second generation migrants. Area (B) represents most probably the retirement migration. This area is characterized by a high % proportion of usually resident foreign population coming from the Most Developed Countries, a high % of women and an older age structure. Area (C) represents the recent women migration flows for labour reasons. It is characterized by a high % of women coming from Central and Eastern European Countries belong to UE, a low % proportion of usually resident foreign population age <18 years old and of second generation migrants and a low % proportion of usually resident foreign population. The results of our research provide some keys of interpretation about the relations between space and foreign population in Italy. The individuation of three areas with a high level of inner homogeneity and, at the same time, very different one from the other underlines the need of building up migration policies that take into account the spatial dimension of migration phenomena.

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The Developments for the Quality Evaluation of the Italian Agricultural Censuses

Antonella Bernardini, Matteo Mazziotta, Rosario Romeo and Lorenzo Soriani

Abstract In all the editions (from 1960 to 2010), Istat has certified the quality of the Agricultural Census through the conduct of one or more post-census surveys that could measure the various distortions due to non-sampling error. The past experiences were so relevant that, for the Census 2010, the two major quality surveys that have ever been made in Agriculture are available for starting interviews. The aim of this paper is to analyze and to compare the different methods of the post Census quality surveys carried out during the 60-year history of the Italian Agriculture Census with a focus on the last experiences.

Key words: quality evaluation, reinterview, coverage survey

1 Introduction

The incidence of non-sampling errors, particularly in complex investigations such as those on agricultural topics in which a considerable effort of memory and knowledge of the phenomenon are required, can seriously affect the reliability of final results. The awareness of this problem prompts researchers to study survey techniques and methods of results analysis in order to restrict the non-sampling errors as a function of increasing quality of the data. The quality takes on the meaning of precision that is expressed as an inverse function of the error statistics. In a statistical survey two kind of non sampling errors are presented: measurement (or response) error and coverage error. The statistical information quality of the Italian Agricultural Censuses has been documented by Istat with post-Census sample surveys. The aim of this work is to describe some

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methodological characteristics of the past experiences comparing with the quality surveys of the 6^{th} Agricultural Census.

2 The past experiences

From 1961 to 1990, the data quality certification was based exclusively on the estimation of measurement error and its main components. Istat, through sample surveys assessed the difference between the actual value of some important variables, selected by Census questionnaires, and the observed value. During the six Census editions, the techniques of investigation used have been made many improvementes; in fact, they passed from the direct reinterview using the same interviewers to reinterview survey with CATI technique (Computer Assisted Telephone Interviewing), greatly reducing the time of data collection. Besides, a computerized mechanism for reconciliation between the data collected at the Census and the data collected by CATI has been substituted the "paper and pencil" technique.

For the coverage error, only in 2001, during the 5th General Census of Agriculture, Istat has applied a methodology already applied for the Census of Population (Istat, 2009) that could provide a direct estimate of coverage by having recourse to an areal sample survey. In fact, the calculation of the coverage rate, as implemented in the Italian agriculture censuses from 1961 to 1990, was estimated not directly with a survey but indirectly, through the updating of the lists.

At the 3th Agricultural census the data quality was assessed by reinterview data collected on a sample of respondents (Schirinzi, 1995). The potential source of measurement errors can be: the structure of the questionnaire, the respondent, the interviewer, the coding of variables and following these steps. The errors caused by these sources and their interactions determine the overall error of the survey.

The main objectives of this survey after the census were:

a) identifying the questions that most frequently give rise to inaccurate results, irrespective of their causes;

b) identifying the most recurrent types of error in the main questions of the questionnaire;

c) measuring the distortions of the main characteristics.

The survey was carried out on a sample of approximately 10,000 farms selected from those already interviewed in the Census.

The sample was designed to provide estimates for the whole national territory and for the 5 geographic divisions. The sampling design is two stages with stratification of primary units (municipalities). In each stratum of the first stage the municipalities were selected with probability proportional to the number of the existed farms, with the assumption that the number of farms of municipality is connected with the data collection process and therefore it is correlated with the quality of data.

For the measurement error, two different models with the same variables are used: the first is compiled by the municipal office, using the data in the census questionnaires about the farms of the sample and the second model on the survey, compiled by detectors at the time of the interview.

Subsequently, the Istat matches the questionnaires, for the same farms, using the respective identification code, and it verifies the number of errors and inconsistencies.

The interviewers were selected from the Census; in particular the interviewers that had shown high level of capability and a particular effort to work. The interviewers have not collected data for the same farms the Census.

Many tests have been carried out, over the years, in order to evaluate the effect of the interviewer. In the post-census survey of the 3rd Agricultural Census, in addition to information on 10,000 farms, some data about the characteristics of the interviewer were collected, in order to calculate the interviewer effect. Same variables collected were level of education, employment, age, province and municipality (Mangano, 1984).

In the 4th Agricultural Census, in order to estimate the interviewer effect, the interpenetrating sampling technique was used (Istat, 1995).

In the quality surveys of the 2001 Census (Mazziotta et al., 2007) many innovations both methodological and organizational have been introduced. In fact, two surveys were carried out, the reinterview survey and the coverage survey:

1) The aim of the reinterview survey is to estimate the measurement error and its main components in relation to certain important variables selected by the census questionnaire. The survey, carried out on a sample of about 7,800 farms already recognized at the Census, is based on a reinterview performed with technical phone (CATI). The variables selected by the Census questionnaire are: i) major crops, ii) the consistency of the main cattle-breeding, iii) family and other personnel employed in the farm in the year 1999-2000. The reinterview included about 50 questions, 25 of which involving reconciliation as part of the reinterview process. The objective of this process is to obtain unbiased estimations of the response error components;

2) The aim of the coverage survey is to estimate the number of farms actually exist in the reference time period of the Census (October 22, 2000) and the coverage rate defined as the ratio between the number of farms carried out in Census and the number of farms that actually exist. The coverage survey is based on a areal sample involving about 150 cadastral maps of the land registers. The detection technique requires that the interviewer, from information on the owner of land parcels, discovers the farm and the conductor that are on sampled cadastral map (Mazziotta and Russo, 2002).

The reference territory domains (for the 2 post Census surveys) are the whole national territory and the 5 geographic divisions.

3 The quality surveys of the 6th Agricultural Census

In the two quality surveys of the 2010 Census, the same design of the 2001 is proposed. The main differences concern the sample sizes, in fact for the reinterview 50,000 farm will be contact by CATI technique and for the coverage survey the census is replicated in 1,500 cadastral maps. The reference territory domains (for the 2 post Census surveys) are the whole national territory, the 5 geographic divisions, the 21 regions; furthermore, in order to estimate parameters at the provincial level small area techniques will be adopted.

4 Concluding remarks

The quality evaluation of the Agricultural Censuses had many developments during the time. The aim of the Istat is to provide accurate estimates of the main non-sampling errors, in fact in the first four editions only one quality survey (reinterview) was carried out. From the fifth edition has been planned the coverage survey based on an areal sampling. This survey presented different innovative aspects from methodological and organizational point of view. These experiences have driven the Istat researchers to replay the same scheme of survey for the last Agricultural Census. Two quality surveys will be carried out: the reinterview for 50,000 farms and the coverage survey conducted in 1,500 cadastral maps. These innovative developments will allow to obtain estimates at regional level; besides the progress of the small area estimation techniques permits to evaluate the Census quality, for the first time in Italy, at the provincial level.

Acknowledgements

Lorenzo Soriani has written Section 1, Antonella Bernardini and Rosario Romeo have written Sections 2, and Matteo Mazziotta has written Sections 3 and 4.

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Developing a composite indicator of resident well-being: the case of the Romagna area

Cristina Bernini, Andrea Guizzardi and Giovanni Angelini

Abstract There is a growing literature on the assessment of quality of life conditions and well-being in geographically and/or politically divided areas.. The paper proposes a new measure of well-being based on residents' satisfaction with specific life domains, leisure activities and satisfaction with life as a whole. The well-being index is constructed using a Weighted Sum Model, where the weights are calculated by DEA.

1 Introduction

Researchers have used various approaches to define and measure a complex, multidimensional construct of quality of life (QOL), such as social indicators, subjective well-being measures (SWB), and economic indices. In these frameworks, Composite Indicators (CIs) have increasingly been accepted as a useful tool for benchmarking, performance comparisons, policy analysis and public communication ([5]). A CI is a mathematical aggregation of a set of sub-indicators for measuring multi-dimension concepts that cannot be captured by a single indicator. Its construction, however, is not straightforward and involves a number of steps that need to be carefully examined. First step regards the choice of a model for the multi-dimensional concept that is being measured. Then, individual indicators have to be measured and a 'weighting and aggregation' technique should be defined. Following [4], the last step is a major one, affecting directly the quality and reliability of the resulting CIs. The Authors underline that the determination of weights could take advantage of additional information from experts but - whatever the weighting and aggregation technique – it may be difficult to reach an agreement on such weights among the entities compared as each entity has its own specificity.

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Subjectivity in determining the weights for sub-indicators is the main problem in the construction of a CI. To overcome this problem, in this paper we suggest using an optimization approach able to look for endogenous and entity-specific weights. We propose to determine the weights for sub-indicators by solving a data envelopment analysis (DEA) linear programming problem that requires no *prior* knowledge of the weights for sub-indicators.

We apply the proposed approach to measure the resident subjective well-being (SWB) of various groups of people who differ by gender, age and administrative sub-area where they live. Following [1] we define SWB as a broad construct that includes people's satisfaction with specific life domains, emotional responses, and satisfaction with life as a whole (overall or general life satisfaction) ([2]).

As a case study we consider residents in the Romagna area and in the close State of S. Marino, a developed territory homogeneous in term of economic and social standards, and cultural heritage. When people are able to satisfy basic biological needs, fulfillment of psychological needs as well as leisure activities become an important source of their SWB. In this sense, limiting the study to the Romagna area allows us to measure SWB combining aspects tied to material life, leisure time and happiness or self realization.

2 The method: WSM and DEA approach

Assume that there are *m* entities (that is individuals), whose CI*s* are to be calculated based on *n* sub-indicators. Let I_{ij} denote the value of entity *i* with respect to sub-indicator *j*. Without loss of generality, all the sub-indicators are assumed larger than unity and of the benefit type (they satisfy the property of ''the larger the better''). The purpose is to aggregate I_{ij} (j=1, 2, . ., n) into a composite indicator CI_i for entity *i*.

The weighted sum model (WSM) is a major data aggregation technique in CI construction. The use of the WSM requires the pre-determination of the weights for all the sub-indicators. Supposing that the weight for subindicator *j* is w_j, then the WSM can be formulated as:

$$CI_i = \sum_{j=1}^{n} w_j I_{ij}, \quad \text{i} = 1,2,..,m \qquad (1)$$

Even if the WSM is the earliest and probably the most widely used method, it implies a subjectivity choice of the weights. To overcome this problem, we suggest using DEA to construct weights for CI*s*, avoiding the subjectivity in assigning the weights.

The DEA is a lineal programming technique traditionally used to estimate the efficiency of a Decision Making Unit (DMU) within production contexts characterized by multiple outputs and inputs. The DEA technique has come to be used in a broader number of applications, not only ''productive'', evidencing the flexibility of DEA as a valid tool of multidimensional analysis. Some of the most relevant novel uses of DEA in recent years have been its application to the analysis of standards of living and social well-being [5] and territorial diffusion index of infrastructures [3].

DEA offers an alternative mode of tackling the basic problem of constructing synthetic indicators. The assignation of weights must be carried out objectively, whilst at the same time respecting the inherent subjectivity with which the distinct individuals might interpret their wellbeing or standards of living. DEA allows to satisfy this dual premise.

It constitutes an objective tool, since it does not require the assignation of *a priori* weights. Moreover, it is flexible in setting the weights for each of the units that are being compared. That is, the weighting structure is the one maximizing the score of each entity subject to the constrain that it has to be unique across entities.

3 The data

Data were collected in the Romagna area in 2010, involving residents. The sampling design was based on stratification with respect to: provinces (Rimini, Forlì and Cesena; Ravenna; San Marino) and demographic characteristics (age and gender). Almost 810 questionnaires were distributed to residents, randomly chosen, by means of a "face to face" technique. Questionnaires were administrated in the place where residents live.
Following the SWB approach, the questionnaire is constructed to capture residents' satisfaction in respect to three main dimensions that are: satisfaction with specific life domains, leisure activities and life as a whole. In particular, we suggest evaluating the three different domains by using the following variables:

1. Specific life domain: material status, health, work, family, religion/spirituality
2. Leisure activities: social relationships, sport activities, hobby, shopping, culture, entertainment, holiday
3. General life satisfaction: with personal life, with the main life dimensions, with respect to personal goals, compared with peers.

Residents were required to give a score (using a Likert-scale 1-7) to each item related to the different dimensions of well-being, expressed in terms of satisfaction.

4 Results

To reduce data and construct 3 independent variables for the DEA, a factor analysis with varimax rotation of the n=17 surveyed items is conducted. The final result confirms the three factors (Specific life domain, Leisure activities and General life satisfaction), having reasonably high alpha coefficients. The weights are calculated by using DEA and maximizing CI as defined in (1), s.t.

$$\sum_{j=1}^{3} w_j I_{ij}, \quad \leq 1000 \;\; \forall \; \mathrm{i} = 1, 2, .., m \quad ; \quad 50 \leq w_j \leq 1000 \cdot$$

Coefficients w_j take value *344; 437; 286*; respectively for the three considered factors.

We show that leisure activities is the most affecting factor in SWB of residents in Romagna; the general life satisfaction the lowest important. As in [1] we confirm the general hypothesis of positive relationship between participation in leisure and SWB.
Once the weights have been calculated, the CI index, for each resident, is obtained by eq. (1). The final well-being indexes CI for the Romagna area, the different provinces and in respect to demographic characteristics are calculated by average of CI_i. The results are given in Table 1 and are self explaining.

Table 1: Well-being index

Provinces	***CI***	***Age***	***CI***	***Labour market position***	***CI***
Forlì-Cesena	0.54	<25	0.67	Self-empl. / Manager	0.61
Ravenna	0.50	25 |- 35	0.57	W. collar / teacher	0.60
Rimini	0.60	35 |- 45	0.62	Blue collar	0.52
San Marino	0.65	45 |- 55	0.52	Retired	0.50
		55 |- 65	0.53	Student	0.66
		≥ 65	0.50	Other	0.57
Whole sample 0.56					

San Marino Citizens show higher SWB than Italian Citizens. It's an interesting – and expected - result that confirms the diffused feeling of an higher well-being in the state of San Marino. SWB decreases with age and labour market position. People through participation in leisure activities build social relationships, feel positive emotions, acquire additional skills and knowledge, and therefore improve their Quality of Life. However it is important to underline that having time for leisure activities does not necessarily imply a greater SWB, as demonstrated by the gap between the two groups having the largest and lowest amount of free time: students (young people) and retired (old people). The difference relies on the possibility to develop projects in leisure or working time, building social relationships and acquiring additional skills and knowledge. Older and retired residents show the lowest value of the SWB index, reflecting their higher attitude in "passive" social relationships than younger residents. The role of an active planning over the life time is also confirmed by the fact that the SWB is higher for people who have a better chance of personal realization (self-employed and manager), respect to those who are engaged in routine tasks such as blue collars or – again – retired people.

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Foreign Entrepreneurship: The New Pillar of the National Entrepreneurial Vocation vs a Latest Shaky Employment

Gian Carlo Blangiardo, Stefania Della Queva, Patrizia Grossi and Flavio Verrecchia

Abstract For nearly a century and a half, since the first official investigation on the structure of the Italian industry (1876), censuses have provided manufacturing establishments as unit of analysis and survey. Yet again, administrative sources are utilized in order to study production units. Today it seems crucial to design and test new information domains. In this context, *le travails*, seems to be very interesting, both for the importance of the issue and the recent availability of new administrative sources. The aim of this paper is to study the potential of an approach that considers workers as statistical units within the processes of transformation of administrative data in statistical information. On the one hand, a change of perspective on the Business Register – ISTAT ensures existence, location and economic activity of entrepreneurs; on the other hand, it allows the retrieval of registry information. The exercise, on the Latest *Shaky* Employment, highlights the applicability of methods and prototypal system of classifications. A particular subset of workers, at this stage, will be used, i.e. foreign origin entrepreneurs (*non* partnership).

Keywords: Foreign Origin Entrepreneur, Shaky Employment, Business Register.

1 Introduction and Methodological Approach

In the recent migration phase, the immigrant entrepreneur plays an emergent role in Italian economic structure. The ISTAT Business Register [1, 5] ensures existence, location and

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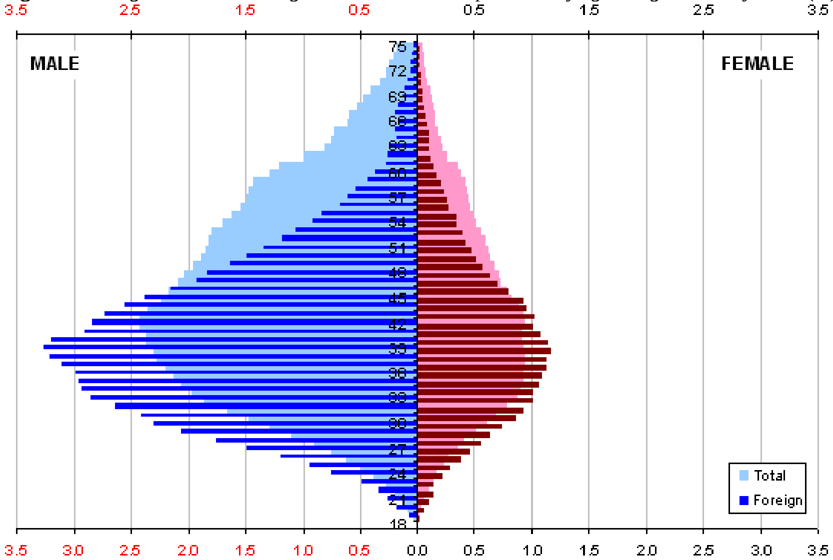
economic activity of foreign[1] extra-agricultural[2] micro-entrepreneurs[3] (FEAME). These entrepreneurs are not foreigners *tout-court*, they are immigrants - i.e. not Italian by birth[4]. The overestimation (Italian citizens born abroad, i.e. *ius sanguinis*) and underestimation of foreign entrepreneurs (foreign citizens born in Italy) affect the data. In this work we use demographic traditional techniques and multivariate analysis of economic data - i.e. *tandem analysis*[5] on entrepreneurial specializations by country of birth.

2 Results

In 2007[6] FEAME amount to 7% of micro-entrepreneurs. Looking at the age structure pyramid (Fig. 1) an average younger over the total micro-entrepreneurs can be noticed; moreover, the firm size - 26% of firms has more than one person employed – highlights an increased importance (Tab. 1). The analysis of FEAME typologies requires the use of ACP that helps to make economic and social phenomena intelligible. The ACP on the specializations indices defines the pillars (Tab. 2), the linear combinations of original variables, that explain the linear variability of the phenomenon under study. The application allows to synthesize the seven variables initially considered in three main components, explaining the 82% of the total variance and showing an high communality (.6, except for "H" equal to .47). The reduction of complexity and the projection of variables on the Cartesian axes, defined by two rotate components[7], allows to see the sign, the intensity of the relation variables-components and the variables represented by each pillar. The first component - which explains about 36% of the variability – represents the dimension of the *Services activities* that incorporates information concerning *education, human health, social work activities and entertainment.* The second component - which explains 27% of the variability – represents the *Industrial activities and trade* positively correlated to *manufacturing, wholesale and retail trade* and to *construction* is negatively correlated. The representation of the ethnic groups on the first two factors by cluster analysis (Fig. 2) allows to define some typologies (in other cases in-depth studies will be required) as: *Shaky employment (SHAKY)*; *Education activities (EDU)*; *The Chinese style (MAN); Trade and transportation (TRATRA)*; *Trade activities (TRADE)*.

[1] The tax code defines the place of birth. The data quality can be improved through controls.
[2] NACE Rev 2.: B: mining and quarrying; C: manufacturing; D: electricity, gas, steam and air conditioning supply; E: water supply; sewerage, waste management and remediation activities; F: construction; G: wholesale and retail trade; repair of motor vehicles and motorcycles; H: transportation and storage; I: accommodation and food service activities; J: information and communication; K: financial and insurance activities; L: real estate activities; M: professional, scientific and technical activities; N: administrative and support service activities; P: education; Q: human health and social work activities; R: arts, entertainment and recreation; S: other service activities.
[3] Self-employment - firm (Fi), freelance (Fr), (free) professional (Fp) – with less than 10 persons employed and with a turnover less than 2 million both as requirement.
[4] For instance, the German and Swiss FEAME by birth are often Italian citizens.
[5] Principal component analysis (APC) and Cluster Analysis on factor scores.
[6] The analysis data refers to 2007 as pre-crisis year.
[7] The rotation method used is Varimax with Kaiser normalization.

Figure 1: *Foreign and total extra-agricultural micro-entrepreneurs, by age and gender, Italy, 2007 (%)*



Sources: data processing on ISTAT-ASIA archive. **Notes**: a. SAS SW.

Table 1: *FEAME, by size (persons employed) and legal form, Italy, 2007 (%)*

Size	Column %				Row %				Total %			
	Fi	**Fr**	**Fp**	**Tot**	**Fi**	**Fr**	**Fp**	**Tot**	**Fi**	**Fr**	**Fp**	**Tot**
1	69	89	96	74	74	12	13	100	55	9	10	74
2-4	27	10	4	23	94	4	2	100	22	1	0	23
5-9	4	1	0	3	98	2	0	100	3	0	0	3
Total	100	100	100	100	80	10	10	100	80	10	10	100

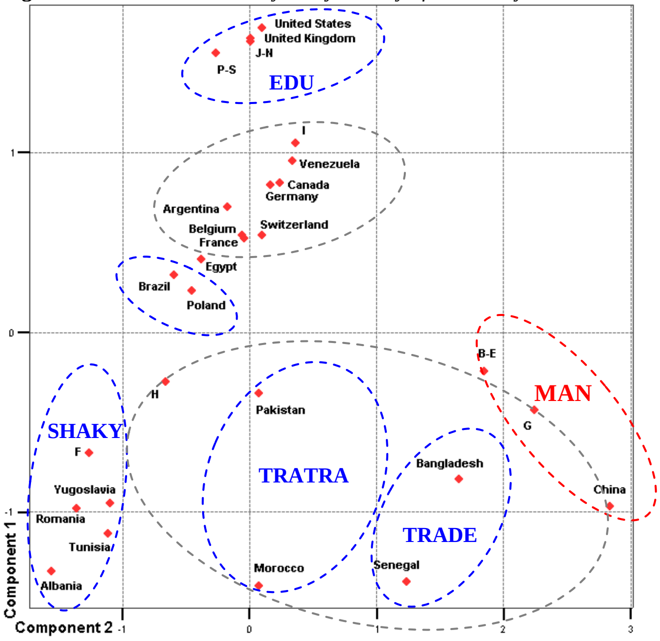
Sources: data processing on ISTAT-ASIA Archive. **Notes**: a. SAS SW. b. see footnote n. 3.

Table 2: *FEAME, by country of birth and economic activity, Italy, 2007 (indices and %)*

Country of birth	Specializations indices, FEAME by NACE = 1							Total (% col)
	B-E	**F**	**G**	**H**	**I**	**J-N**	**P-S**	
China	4.01	0.02	1.82	0.03	1.48	0.10	0.08	12
Albania	0.38	2.75	0.12	0.81	0.35	0.24	0.30	9
Romania	0.46	2.41	0.20	0.80	0.40	0.38	0.73	9
Switzerland	0.83	0.54	1.04	0.95	1.36	1.54	1.45	8
Morocco	0.46	0.90	2.05	1.57	0.32	0.33	0.15	7
Germany	0.77	0.52	0.99	0.80	1.90	1.49	1.57	7
Yugoslavia	0.48	2.26	0.37	0.68	0.46	0.53	0.53	4
France	0.75	0.59	0.99	1.00	1.16	1.58	1.54	4
Egypt	0.57	1.38	0.55	0.87	2.90	1.21	0.42	3
Tunisia	0.74	2.01	0.54	1.49	0.68	0.42	0.38	2
Argentina	0.86	0.57	0.80	1.11	1.07	1.77	1.75	2
United Kingdom	0.48	0.22	0.73	0.53	1.23	2.52	2.33	2
Venezuela	0.68	0.27	1.13	0.62	1.31	2.00	1.63	2
United States	0.39	0.15	0.84	0.39	1.21	2.40	2.55	2
…	…	…	…	…	…	…	…	…
Total	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
Total (% row)	10	30	27	3	5	14	11	100

Sources: data processing on ISTAT-ASIA archive. **Notes**: a. SAS SW.

Figure 2: *FEAME tandem analysis, by country of birth, Italy, 2007*



Sources: data processing on ISTAT-ASIA archive. **Notes**: a. SPSS SW.

3 Conclusions

Within the limits of data analyzed, thanks to the new approach [4] interesting results and new research areas emerge. A *shaky employment* - (i.e. masons from Albania and Romania), *high skills* (i.e. entrepreneurs from UK engaged in education services or those from France in medical offices services) and *true business realities* (i.e. 26% of the FEAME have from 2 to 9 employees) has been observed. Finally, the endowment index is equal to 2.7 for *Chinese style FEAME* and is about 35% below the average (6%) for *Shaky* – i.e. FEAME on the total foreign population [2, 3].

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The long journey of Italian migration statistics: from mass emigration to mass immigration

Corrado Bonifazi[1]

Abstract The last 150 years of Italian history include all the main steps of the evolution of a national migration system. In fact, for almost a century Italy had been one of the most important countries of emigration in the world, while nowadays it has become one of the favorite destinations of international migration flows. The paper is an attempt to describe the main changes in Italian migration statistics, highlighting the relations between these changes and changes in migration policies and migration trends.

1 Introduction

The history of the first 150 years since unification saw Italy go through all the main steps that a national migration system can meet during its evolution. Just think that, for almost one hundred years, Italy has been amongst the main countries of emigration in the world, though now it has become one of the main destinations for international migration. From the beginning of the new State, the importance of migration has led to an attempt by official statistics to measure its intensity. Since then, Italian migration statistics have experienced profound changes in sources, definitions, and methods of data collection. These changes are closely intertwined, on the one hand, to the evolution and dynamics of migration flows and, on the other, to political choices in the migration field. In fact, it is well known that in every country statistical information on the phenomenon tends to focus on specific categories of migrants subject to political interest and, therefore, to move its attention according to the changes in needs and demands of national policy (Kritz 1987).

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We will try to describe this process, aiming to grasp some of its most important aspects and taking into consideration the four main periods in which we can divide the history of Italian migration: the period of mass emigration from 1861 to the First World War; the inter war period, the period of European labor migration, from 1946 to 1975, the period of mass immigration.

2 Italian migration statistics during the mass emigration of the first globalization

The birth and development of Italian migratory statistics should be included within an international context in which, already before 1861, the problem of collecting comparable information about such a social dynamic, which was growing in importance on the world stage, had already been raised. In fact, as early as 1853, the first International Statistical Congress in Brussels, in its conclusions, identified some guidelines for collecting comparable data for the measurement of international migration, particularly the trans-oceanic types (CGS 1853). The central point of the proposal envisaged the creation of municipal registers of the emigrants in order to gather information on those who moved to another country and alongside such registers, in order to measure the incoming traffic, registers of immigrants. Gathering information at ports of departure and arrival on emigrants and immigrants was recommended as a control strategy. Therefore, since then, two key instruments that are still essential in the measurement of migration were identified: the population registers and statistics on departures and arrivals.

In the early post-unification years, migration certainly was not a priority in a country that was yet to be built and neither was for the newly formed Office of General Statistics that belonged to the Ministry for Agriculture, Industry and Commerce (MAIC). In the first census of 1861 there was, however, information collected on internal and international mobility. In particular, the birthplace was considered to distinguish within the stable resident population people born in the municipality of residence from those born in another municipality, and people born within the kingdom from those born in foreign countries. In addition, information was collected on seasonal migrations, distinguishing between those that occurred within unified Italy and those that moved abroad.

In fact, the prevailing models of mobility, at the time of the unification of Italy, were still the traditional ones related to agricultural activities in the Po Valley and the Roman countryside or to transhumance. The extent of emigration to other countries was small. Even if some migratory flows had already begun before unification and in some local areas international migration had already become an important element in the economic family strategy. Overall, however, Italy was still far from reaching those continental and extra-continental migration flows that will characterize the latter part of the century. Just consider that in neighboring France, the census of 1861 showed 76000 Italians, next to 85000 Germans and 204000 Belgians, or that the U.S. Census of 1860 counted less than 12000 Italians when the Irish were already 1.6 million, the Germans nearly 1.3, and the British almost 600000.

The first decade of unification represented an important moment in the evolution and transformation of Italian migration, with the gradual emergence of new patterns of mobility, the enlargement of emigration area and the growth of migration flows. Emigration thus began to take on an increasingly important role in the life of the country. On a political level, such an increased importance resulted in a debate that was most vigorous. On the one side there were those who feared the consequences of this phenomenon and wanted it to be controlled to avoid loss of human resources for the country and on the other, whose who considered it an inevitable result of the economic and social transformations that were taking place (Marucco 2001).

The comparison also moved quickly onto a question of _numbers. The first census of Italians abroad was completed in 1871. The survey proved itself largely inadequate to provide an accurate understanding of the phenomenon and led to estimate between 432000 and 478000 units “the approximate number of Italian residents or visiting in other countries on the night of December 31, 1871 ” (SGRI 1874, II). In 1871 the results of a semi-official survey by Leone Carpi were also published. Carpi had some collaboration from the Ministry of the Interior and the Foreign Office. In 1872 the Statistical Council urged for the establishment of an emigration statistics (MAIC 1872) which, after various studies, was launched in 1876.

The measurement of the phenomenon was seen as an essential tool to assess the causes and effects and to «put an end to the “controversy over the figures” around which, until then, pro and opposition opponents of the Exodus had clashed » (Marucco 1996, 155). The debate within the Statistical Council concerned, first of all, the very basic position on migration. Proponents of migration were well represented by Luigi Bodio, Secretary of the Board since 1872 and subsequently Director of the Directorate of Statistics, who considered migration a fact of life and a right that must be recognized to all. Opponents were represented by Giovanni Florenzano, author of an emigration statistics for the Province of Naples published in 1874. He, in contrast, saw the migration outflow as a serious detriment to the agricultural economy of the country.

This diversity of positions was also on a more strictly technical level. The line taken by Bodio, which then prevailed, was to point to official statistics, «conducted according to scientific methods and carried out with proper tools, quite willing to limit its aspirations rather than to venture into uncertain terrain» (Marucco 2001, 64). Florenzano feared that such a situation would hide the real intensity of the phenomenon, which would result in preventing or delaying government intervention to discourage emigration. Furthermore the first results of the new survey counted about 108 000 units as the outflow in 1876, while the estimates by Carpi counted nearly 152 thousand units in 1873 (Bodio 1877).

Apart from the political factors, we find in such a diversity of positions the main conceptual node that still characterizes the debate on migration statistics, with the confrontation between the needs and limitations of official statistics on the one hand, and knowledge needs, on the other. In this sense the position of Bodio, careful in identifying as objectively as possible measurement criteria, intrinsically contains the fundamental character of a modern statistical survey which must be based on reliable data and whose limits of coverage and reliability are particularly clear. In this case, the lack of a law that would precisely establish who an emigrant was, made the definition of the modalities of the survey even more complex, by lacking an essential contribution to the construction of the information process.

However, the definition of the criteria of a survey, that through successive changes and adjustments accompanied the entire history of Italian emigration, was anything but linear. On 2 March 1874, the Board of Statistics and the Advisory Commission on pension funds and work, in a joint meeting, identified a number of requirements for the statistics on emigration (MAIC-DS 1880a). It is a long list of needs, many of which proved to be impossible to achieve. In fact, the initial path of the source is characterized by a gradual adjustment of its ambitious knowledge goals to the feasible statistical tools. One difficulty which is testified by the wide range of responses by the prefects to the request of the Directorate of Statistics to specify the modalities for the effective collection of data transmitted (MAIC-DS 1880b).

Ultimately the source, up until the changes made in the early twentieth century, considered migrants as emigrating people in poor economic conditions and based the collection of data on clearances granted by the municipalities for the issuing of passports, supplemented by other information. The most apparent limit of the survey, very clear from the beginning to the Directorate of Statistics, was the obvious discrepancy between the number of clearances and passports granted and actually used. This was also at a time when the possession of such a document was not essential to expatriation.

However, beyond this and other limits of the survey, it must be considered that the characteristics of Italian emigration from the start of the phenomenon and the deficiencies of the administrative system made it difficult to use other methods of data collection. In the Italian case, in fact, emigration was initially mainly directed to other European countries, thus making it less meaningful to a system based on boarding lists. This was unlike the situation in other countries where the bulk of the phenomenon was for departures towards North and South America or took place within national borders. The choice of creating registers of emigrants, as suggested in the conclusions of the International Statistical Congress of 1853, would then have been impractical given the difficulties to set up an effective system of population registers, whose creation had been expected as early as 1862 (Marucco 1996) but whose practical realization did not take place until 1929.

The last quarter of the nineteenth century witnessed a considerable growth in the migratory exodus, within an increasingly favorable framework of the phenomenon: for the first time the expatriates in 1887 exceeded 200 thousand units and in 1900 reached almost 353 000. On the side of the push factors, the start of the demographic transition, the development of new economic activities and the crisis of large sections of the traditional economy, led to an increase in the need to emigrate. Furthermore emigration soon came to be the most effective and direct way of improving the quality of life for ever larger segments of the population, while the effective action by a range of actors was stronger (especially the shipping companies and migration agents) and whose actions created a real economy of migration. Then, the attractive factors, were no less intense. In European countries, migrant workers carried out integrative and substitutive jobs in those areas that were deserted by the local workforce, especially in agriculture and in large public works (Bade 2001). On the other side of the Atlantic, countries promoted immigration to promote their development, encouraged by the extraordinary improvement in shipping and the lowering in the cost of crossing (ibid.).

The migration issue entered the Italian political debate with even greater force. Though, for the first law on the matter, we must wait until 1888, after a lively parliamentary debate and characterized by an evident conflict of interests between the agrarian South and the shipping Companies (Ostuni 2001). The law that would definitively regulate the great outflow would see the light of day only in 1901, and was essentially a measure of compromise between the needs for protection and promotion of emigration. The law would foresee the creation of the General Commissariat for Migration (CGE), whose director was Luigi Bodio, and contained the first official definition of the emigrant, at least as far as ocean flows were concerned.

With the arrival of the twentieth century, out-migration grew tumultuously: in 1901, 533.000 expatriated and in subsequent years such a phenomena reached levels that would never be reached again, with a maximum of almost 873.000 expatriates in 1913. The focus had now passed to the promotion of emigration, also thanks to the CGE. The macroeconomic effects of migration, through remittances had meanwhile reached a remarkable size, ensuring that the major economic changes of the Giolitti period come to be in a situation of significant trade deficit coverage (Sori 2009). Ultimately, the first fifteen years of the twentieth century represented an extraordinary moment for Italian emigration, in which all elements of the process have helped to foster its growth.

Although statistically the new century brought important changes. From 1904, the collection of data on expatriates was based on the records of passports held by the District Offices of the Ministry of Interior, which represented a definite improvement (CGE 1926). There remained, however, wide margins of difference between those statistics and the intensity of the phenomenon (ibid.). The issue of a passport, in fact, did not necessarily imply migration. Transfers without a passport grew due to the number of states that did not require such a document. Hence, it was not always possible to determine with accuracy the country of destination and, given the three years of duration of a passports' validity, more movements abroad were possible for the same person.

The CGE too began its own independent survey of ocean flows in 1902, based on the boarding lists and the data was collected on both outward and return movements. The latter formed the basis for statistics on returnees, which would fill a significant gap in a country where return migration and circular mobility have always held a great importance in ocean flows. The major limits of the CGE survey are related to the exclusion of those who traveled in a different class from third class (also due to decisions by the carrier in order to not pay the required fee), for those who departed from foreign ports (excluding Le Havre but only for the northern Italian emigrants to New York and using the ships of the Compagnie Générale Transatlantique), and those who worked on ships during the journey (CGE 1926; Birindelli and Nobile 1996).

The arrival of the First World War marked the end of the first globalization and of a time when international migration had been an essential element in the functioning and development of the world economy. After the war, as we shall see in the next section, all the coordinates of the issue radically changed and a new era for Italian and international migration was born.

3 The Inter-war period

With the conclusion of the conflict, the movements of people were subjected to increasingly stringent controls and restrictions by the states of destination, while the global economy had difficulty in recovering pre-war growth rates and, in 1929, would enter one of its deepest crises. The transoceanic flows were reduced greatly and, in particular, Italian emigration suffered, being subjected to particularly stringent constraints in the United States which, before the conflict, had become the main destination. Also migration flows between European countries met with a sharp decline as a result of poor post-war economic conditions and political restrictions. Only France continued to have a policy of attracting flows, at least until the effects of the crisis in the early thirties would bring about a significant reduction in migration (Bade 2001).

Restrictive immigration policies, economic problems, and economic crisis brought about a total re-articulation of migration processes and prevented the restart of the mechanism of labour transfer that had characterized the entire first globalization. Italian politicians pointed to a resumption in emigration, which seemed to take place immediately after the war with over 600 thousand expatriates in 1920. In the following years, though the values decreased, they remained at high levels (between 141 000 and 390 000 units up to 1931), but they did not reach the size recorded before the war. Fascism pursued, initially, the same policy followed by liberal governments of promoting emigration. It was the "speech of the Ascension" of 26th May 1927, that initiated a change in direction (Nobile 1974). The regime introduced increasingly stringent regulations that added an internal obstacle to the external ones already posed by the immigration countries and by the difficult economic conditions (ibid.). The overall result was a further sharp reduction in expatriates that, since 1932, went down to below 100 000 units annually.

From the statistical point of view, the collection of data on international migration experienced, during the conflict and the interwar period, several changes and improvements despite the great difficulties the official statistics encountered until the creation of Istat in 1926. In 1914 changes in the definition of migrant were introduced to take into account the new definition of the law aiming at the legal protection of migrants of 1913.The source, therefore, regarded those who went abroad to perform manual work, to operate small businesses, or to reach family members who had already emigrated for work reasons. From 1928 onwards these groups were joined by the intellectual workers (Mignozzi 1957). From 1915 the summary models compiled by the prefectures were replaced by individual records processed directly by the DGS (ibid.).

Since 1921 the survey of returnees was also extended to countries in Europe and the Mediterranean. But the most significant change, also introduced in 1921, for the statistics of the phenomenon, was the use of collecting coupons included in the passports and withdrawn when boarding, disembarking or crossing the border. The information thus collected was supplemented for flows to and from non-European countries by the lists of names of those on board. This innovation allowed for the overcoming of some of the shortcomings of the survey described above. Critical areas that remained were related to illegal migration, the multiple departures throughout the year, the use of passports granted for reasons other than emigration, and the ineffectiveness of border controls. According to CGE (1926) these problems concerned mainly the flows to European countries.

The introduction of these new methods coincided with the passage of the responsibility of surveying to the CGE. With the removal of the CGE, in April 1927, the office responsible for surveying passed to the Directorate-General for Italians Abroad and, since November 1929, ended up employed by ISTAT (Rosoli and Ostuni 1978).

In addition to limiting the emigration abroad, the regime also focused on reducing internal migration. Again this presented a radical change in direction compared to the previous policy of encouraging the growth of large cities (Treves 1976). The first constraints on internal mobility were introduced in 1928, strengthened in 1931, and made even more stringent in 1939. With the latter measure, the transfer of residence in municipalities with more than 25,000 inhabitants, or of considerable industrial importance, was tied to the possession of a job at a time when the law on employment reserved the possession of a job only to residents (Ivi). This created a vicious circle of a legal and administrative nature, from which one could not escape without actually being in a state of irregularity.

Paradoxically, when Italy started the policy of having an internal migration barrier within the country, it was finally able to have a full annual survey system for internal migration. Only in 1929, in fact, were all municipalities endowed with the population register, thus ensuring the full coverage of the recording of data of registration and cancellation of residency which, in a partial form, had already begun in 1902 (Golini 1974). So we added another source of information on internal mobility to the census data on the place of birth, found in almost every census and, from 1901, elaborated jointly with the place of residence.

A base of uncertainty lies on the migration statistics of the period, as they were linked to the possible intervention of the authorities on records that directly addressed issues that the regime considered of great importance. A direct intervention by Mussolini is certain on the reduction in the number of questions for the 1936 census, which led, inter alia, to the elimination of the question on the place of birth, that could highlight the poor performance of the policy adopted by the regime against urbanization (De Sandre and Favero 2003). It is more difficult to assess the existence of a possible misuse of data, always lurking in authoritarian regimes. In this regard, recent studies arrive at optimistic conclusions considering that the «important political interference, [...] while influencing the content of observation and the institutional tasks of the organization, did not [...]affect (distort) the substantial quality of the research and analysis» (ibid., 49).

4 The European labour migration period

The end of World War II marked the opening of a new phase in the European migration scenario. In fact, after the end of the first post-conflict emergency most of the Western European countries experienced three decades of extraordinary economic growth and in which immigration played a major role. As for Italy, the end of hostility and the fall of fascism marked a return to a policy of active encouragement of emigration. The country aimed to resume the same role it had had during the first globalization and the right to emigrate was present in the Constitution of the Republic, as if to confirm a clean break with the Fascist policy of autarkic closure.

The political orientation in favour of emigration resulted in two different levels of intervention in a situation characterized by a strong commitment by the entire governmental structure and the public apparatus to achieve the objective of maximizing the output fluxes (Bonifazi 2005). On the one hand, we aimed at concluding bilateral agreements with countries willing to accommodate incoming flows; on the other, we sought to promote the Italian interest of encouraging emigration internationally, particularly concentrating the efforts within the international organizations that saw the light in those years.

The output volume grew rapidly, returning in 1947 to 254 thousand units. Until near the end of the seventies, the number of expatriates, even reflecting changes dependant on the phases of European labor markets, kept the numbers up to between 200 000 and 387 000 units. In the first part of this period, Italian workers formed the bulk of European migration for work purposes. This was replaced, however, over the years by flows from other Mediterranean countries.

This resurgence in migration coincided with a period of extraordinary growth in the Italian economy and especially the final transformation in the industrial sense of the production structure of the country. The result was that, for the first time since unification, interregional internal migration came to be seen as a real alternative to emigration towards foreign countries (Sonnino 1995). In fact, between 1955 and 1965, the South and the North East lost 1.7 million inhabitants in the interchange of internal migration, while at the same time the total loss of the whole country to foreign countries was just under one and a half million. This exceptional rate of internal migration imposed the abolition of fascist laws against urbanization, which only took place in 1961 (Ribolzi 1962) when we eliminated from our system "a law that re-established a kind of serfdom, according to the effective expression by a liberal such as L. Einaudi" (Sori 1979, 473).

The maintenance of the law on urbanization, during a period of strong growth in internal migration, created large problems for the functioning of the municipal registers and, consequently, of the statistics on internal mobility (Di Rienzo 1957). Data prior to 1961 is underestimate, as evidenced by the extraordinary peak in the series of registration and cancellation from population registers in the period 1961-1963, in which the effects of the abolition of anti-urbanism were added to the post-census regularizations. In terms of internal migration statistics, it should also be noted that the Anagraphic Rules of 1954 established the simultaneity of the registration and cancellation of residence. This innovation involved the introduction in 1955 of a new survey form, filled out by the municipality of registration and whose information should be confirmed by the municipality of cancellation (ibid.). This allowed for the collecting of accurate information on the interchange between the various territorial realities , and thus have a broader view of ongoing processes.

As regards migration abroad, since 1955 data of population registers is also available on cancellations and registrations to and from other countries, which represented a new source for the measurement of international migration. In reality, however, the source of reference remained the survey of expatriates and returnees for the whole period considered. In this source the definition of emigrant was further enlarged in 1943 to include those who went abroad to pursue a profession, art or craft, or just under the dependency of others to follow or to join family members expatriated for such reasons and finally for those who for whatever reason wished to establish residence outside national boundaries. The coupon system was abandoned in 1955 and replaced, for the flows to European countries, by verifications made by the Italian municipality of residence (or former habitual residence) of the migrants. Since 1969 these criteria were extended to the movement towards non-European countries where, since 1955, the boarding lists and the reports of expatriates registered via airplane were used.

With these changes, which led to the creation of files of immigrants and emigrants bound for foreign countries and held by municipalities (Bonarini 1976), we tried to adapt the survey to the great changes that had characterized the global migration scene in the meantime, especially in the European context. In fact, many of the assumptions and requirements on which the survey was based were actually exceeded. In particular, the birth of the European Community had liberalized much of the movement and migrating could be done without leaving the necessary track for the proper functioning of the statistical survey (Golini and Bonifazi 1990). The result was a progressive loss of information capacity from a source that had accompanied a century of Italian history and would be completely abandoned in the eighties.

5 The mass immigration of the second globalization

The oil crises of the early seventies marked the end of the golden period of European Labour Migration. In the Italian case, it determined the prevalence of departures on the returns and the closure of a migration cycle that had opened before the unification of the country. The first flow of foreign immigrants that started towards the end of the decade faced a substantial shortage in legislation and an equally substantial information gap (Bonifazi 2007). The available statistics were limited to census data on foreign residents and some information on residence permits granted by the Ministry of the Interior, while the population registers data, which noted the in and out movements of foreigners, gave a total value and did not distinguish the foreign residents from the Italians.

The radical change in the dynamics of migration posed the need to redirect a statistical system which captured outflows, then beginning to decline, yet that was unable to give an account of the incoming movements. On these grounds, in the early eighties, the scientific community began to play an important role in stimulating, encouraging and proposing solutions that would enable the national statistical system to provide information on a phenomenon still in its early phase (Natale 1983). In particular, the need for a clear political input, the importance of coordinating the various activities and usefulness of a central role to be assigned to Istat in the construction of an information system on migration (ibid.), were highlighted.

Meanwhile, the political interest in the phenomenon grew. In 1986 the first law on immigration was passed and the debate become more and more lively. As had happened a century before the migration, even in this case, the debate between supporters and opponents found the size of the phenomenon as the first natural terrain for confrontation. A war of figures began, supplied by the little and controversial data available. Thus, at a conference on immigration in 1990, Istat was given the task of preparing one of the basic reports containing a comprehensive review of the available sources and an attempt to estimate the size of the foreign presence (Istat 1991). This estimate, which should have represented a moment of shared knowledge and a quantitative basis on which the different actors could build their analysis and proposals, was transformed, however, into one of the most heated controversies of the entire conference. It was accused of excessive complacency by the "anti-immigrant party" and, conversely, with having the intention of inflating the number of foreigners from the "pro-immigrant one."

In subsequent years, the efforts by Istat continued. The census of 1991 sought to improve the quality of data collected on the phenomenon. A new survey on foreigners registered in the municipal registry saw the light and a satisfactory form was given to the statistics on the permits to stay, eliminating the problem of duplication and missed cancellations. Furthermore information on foreigners was included in many current surveys.

Meanwhile, foreign immigration was consolidating its position within Italian society, becoming a structural element of the reality of the country. The foreign residents moved from 211 thousand units in 1981 to 356 000 in 1991. Due to the fall of the Berlin Wall in 1989 and the consequent end of the socialist regimes, foreign immigration in Italy marked the beginning of a growth phase that, over the years, became tumultuous: in 2001 foreign residents surveyed were 1.3 million and ten years later they would be 4.5 million recorded in the municipal registers.

In the nineties immigration gained weight in the Italian political debate and was noted as one of the main elements of comparison of the alignments. Overall, however, the focus of politics towards statistical information on the phenomenon has been limited and sporadic. The impression is that in recent years, the national statistical system acted in a substantially independent manner in trying to improve and expand its ability to collect data on the size and characteristics of the phenomenon.

In recent years, the final settlement of the surveys on permits to stay and aliens entered into the population register took place. These offered a good base for information on the phenomenon and the census of 2001 gave the foreign presence the attention it deserves. More recently, the availability of the data on foreigners collected in the labour force survey and the distribution by sex and age of the foreign population residing in municipalities, have recovered part of the delay we had when compared to other EU countries. Much remains to be done, particularly in terms of timeliness, because the knowledge demand is increasing and is becoming more pressing over time due to the growth in the scale of the phenomenon. Overall, the statistical information on immigration seems to now start to achieve those results that, in fact, seemed at hand in the second half of the nineties. It is difficult to determine the reasons for this delay. Certainly, a clear and strong political input which should assign adequate resources and direct the activities of the National Statistical System in this direction, is missing (Bonifazi and Strozza 2008). Moreover, in recent years, the stress on the scientific community to improve statistical information on the phenomenon seems to have slowed, while the fragmentation of responsibilities between national authorities within the Sistan, the move of responsibility for producing statistics from Istat to other agencies, and the decentralization of certain administrative tasks, have certainly not encouraged the development of truly organic quantitative information on the phenomenon.

6 Conclusions

The 150 year period since the unification of Italy has seen extraordinary changes in migration statistics. Changes through which we have tried to follow the evolution of the phenomenon and provide an answer to political questions. From this point of view, it should be emphasized that the statistical knowledge of migration is an integral and decisive element of the decision-making process (Kritz 1987). In particular, the statistical system «provides an empirical base for measuring migration experiences and perceptions, and allows governments to assess whether the objectives set forth in national policy are met. [….] A good database becomes central to the policy process: feedback is provided to policymakers on the success of regulatory efforts, and analysis of the database contributes to the elite perception of the role of migration. The database and its analysts play a critical role in the policy process » (Ivi 950).

This function, which reflects a modern understanding of the relationship between decision making and statistical information, was realized by the Italian statistical system in different ways during the long period of time considered. Certainly, statistics on emigration have been an element of reference in political discussions during the Liberal Italy, also thanks to the actions of an important figure, such as Luigi Bodio (Soresina 2001). A more instrumental relationship developed during fascism, when a clear contradiction between the undoubted improvements in the statistical system and on specific surveys, and an interest in pursuing decidedly authoritarian regime objectives in the field of migration, opened.

Paradoxically, the political role of statistical information on migration appears to have declined in recent years. In particular, when considering foreign immigration, the degree of integration and interaction between politics and information has appeared decidedly modest. A central role that statistical information should have in the decision-making process has not been recognized. Often the task of remedying the lack of clear political decisions of policy and organization of the overall system of data collection has been left to the good will of individuals or individual agencies that deal with the problem (Bonifazi and Strozza 2008). The necessary clarity on an essential element of political debate has frequently been lacking and has often fueled a war of numbers that has certainly not contributed to the serenity of the debate.

In the meantime new challenges are entering the agenda of the statistical system (Bonifazi and Strozza 2008). The stabilization of foreign immigration and the growth of a second generation born or brought up in Italy are posing the need to collect information on naturalized foreigners and on the population of foreign origin. Furthermore integration issues are gaining a central role in the evaluation of the overall impact of immigration on Italian society. Some of these questions have already been addressed by official statistics and all are at the core of scientific debate. The long journey of Italian migration statistics is far from concluded, it has a long future in front of it.

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New Technologies and Statistics: Partners for Environmental Monitoring and City Sensing

Giovanni Borga, Rina Camporese, Niccolò Iandelli and Antonella Ragnoli

Abstract Urban space is interconnected thanks to a myriad of technological devices whose data can be aggregated in a geographic database thereby providing a representation of what is happening around us. City Sensing is an "immersive sensing" and a new opportunity to survey the territory and the environment, by the means of low cost sensors small enough to be wearable. Advantages of such a framework are the widespread and numerous measurements at lower unit cost and also the near real-time friendly communication, together with an interaction with citizens. There are, of course, some limits: low-cost sensors' measurements are affected by a greater error; the huge amount of data produced can result in a sort of data overload; pressure for real time can lead to hasty elaborations. Statistics can offer some help to reduce the impact of the drawbacks related to measurement quality control and error estimates and it can also offer possible solutions for significant data synthesis and representation.

1 City sensing and New Technologies

A new strategy for environmental monitoring is outlined by the rapid development of sensors and computer networks: a great number of data acquisition instruments, distributed and interconnected, provide near real-time data flows. A wide spread monitoring network displaces the traditional paradigm based on the use of few stand-alone stations, focusing on the pervasiveness of low cost nodes, equipped with light sensors in order to get a small gridded representation of the territory. Urban space can be interconnected thanks to a myriad of technological devices whose data are aggregated in a geographic database, providing a relevant representation of what is happening around us. Having this in mind, City Sensing becomes an *immersive sensing*

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and a new exciting opportunity to survey the territory. In combination with the Web 2.0 opportunities, City Sensing can be defined as a Sensor Web, to perform environmental monitoring in the style of social networking and from a cooperative perspective [1].

Recent technological research has produced sensors (mainly based on Micro-Electro-Mechanical System) integrated into commonly used instruments (i.e. smart-phones or devices small enough to be wearable and at low cost) that can measure various quantities by translating variations of physical parameters into electrical impulses (e.g. acceleration, temperature, humidity, concentration of gases, magnetic fields, …), or transform built-in microphone in a noise detector. Each mobile phone could become an *environmental station* and a node of a larger monitoring network. The spread of these technologies has opened the door to new research experiences made by the Iuav - NT&ITA Doctorate School and Research Group, such as the design of an integrated system of sensors for environmental and road traffic monitoring (widespread in the territory and based on WSN-Wireless Sensor Network), and the test of a prototype wearable multi-sensor with blue-tooth transmission.

2 Potentials, drawbacks and possible solutions

The main advantages of such a framework are the widespread and numerous measurements at lower unit cost (versus the traditional precise, expensive and few in number measures), the near real-time friendly communication and the possible interaction with citizens. There are, of course, some limits. Firstly, data coming from actual low-cost sensors are affected by a greater error as compared to certified expensive instruments. Secondly, a huge amount of data can be easily and quickly produced; this can result in a sort of data overload, which is difficult to manage and interpret. Furthermore, the pressure for real time data can lead to hasty and un-meditated elaborations. Statistics can offer some help to limit those drawbacks with regard to measurement quality control and error estimates [4]. The main advantages of using a statistical approach could be:

- rationalise the numerous and enthusiastic data collection processes, so as to make them more significant and representative, e.g. in terms of sampling strategies
- raise awareness of measurements' quality control and evaluation of errors
- keep uncertainty of the results into consideration
- enhance the essential role of metadata.

In cooperation with Information Design, statistics can also develop innovative solutions in favour of a significant data synthesis and representation [6,7], especially when multidimensional data have to be considered along with both space and time.

3 Air and noise pollution examples

Here are two examples of how new technologies modify the traditional approach to environmental monitoring. The Framework for the Development of Environment Statistics defined by the United Nations [8,9,10], which is currently under revision, has been taken into consideration as a reference frame for the following reflections.

As to air pollution, UNSD Environmental Indicators essentially regard emissions, while indicators on ambient concentrations of selected pollutants are not present, mainly because they lack quality, coverage across countries and international comparability. As spatial patterns of air pollutants concentration vary significantly across territories and being usually monitored with very few, precise and expensive stations, it often happens that national environmental statistics describe the characteristic of the monitoring network (air monitoring stations: number, type and locations), instead of pollutants concentration. The following quotation comes from a UN document dated 1991: “The cost of environmental monitoring has inhibited the development of statistically valid space/time sampling frames” [10]; it clearly explains the reason behind the state of the art. Low cost sensor networks open a new scenario, where challenges are no more related to the costs of measurement, but to instruments calibration, proper time and space dependent sample strategies, ascertainment of statistical validity, and significant data reduction of massive data sets.

With regard to noise pollution, in 1998 the population exposed to excessive noise (i.e. noise levels exceeding national standard) has been selected by the UN as a suitable indicator [9]. Furthermore, the 2002 EU Directive on Environmental Noise required Member States to draw harmonised *strategic noise maps*. Despite that, actual national statistics on noise pollution often show only the responses to noise pollution, in terms of actions and policies adopted to reduce noise pollution effects. In Italy, for example, noise barriers, low noise pavements, noise zoning are the selected indicators on “noise pollution” in “Urban Environment Indicators” statistical national report [5].

Currently, low-cost noise sensors guarantee a better measurement quality (provided that they are calibrated), as compared to sensors measuring concentration of gases, for which the output measurements are more controversial. Therefore, a hypothetical sample strategy to assess environmental noise in Italy is proposed below. It aims at obtaining noise exposure maps along the roads in urban environments, using two indicators quoted in the EU Directive: day-evening-night level in decibels and night-time noise indicator (obtained through A-weighted long-term average sound levels, determined over all the day periods of a year) [2].

The proposed sample strategy requires stratification according to space and time. As to space, road segments of urban environment could be stratified by techno-functional characteristics related to speed limits and traffic flow (highways, suburban, urban, local). Such information is available in the Catasto Strade (Roads Register), required by law and usually available, in some form, at least for principal towns. Another spatial stratification variable could be the land cover class, such as the one provided by the GSE Land European Urban Atlas Services (part of the European Earth Observation Programme - GMES). It comes from a very high-resolution hot spot mapping of urban functional areas and it allows for their stratification according to different urban fabric density (continuous, dense, medium, low, sparse) and to functional characteristics (residential, industrial, etc.). As to time stratification, the sample strategy could resemble the one adopted for HETUS – Harmonised European Time Use Survey, which covers an entire 12 months period - 24hrs - 7days, with stratification based on month and type of day (Mon-Fry, Sat, Sun). The characteristics of small noise sensors in terms of cost and transportability would easily adapt to such a sample. If a noise map has to be the output, estimates of noise indicators derived from sampled locations would then be used as expected values for the road segments that have not been surveyed, on the basis of spatial stratification variables.

In this view there comes a proposal which could make vein and pulses of an orthodox statistician tremble: to *contaminate* the traditional sampling approach with a wiki component, in the style of collaborative mapping - www.OpenStreetMap.org - and collaborative research - www.GalaxyZoo.org. The first experience shows how Web 2.0 collaborative activities can produce a valid map of the territory. The second is probably less known: a data set made up of a million galaxies images collected by the robotic telescope of the Sloan Digital Sky Survey have been made available on the web and the morphological classifications of galaxies, which enables scientists to understand how galaxies form and evolve, have been carried out by a network of registered web users, after a brief on-line tutorial phase. This experience shows how common citizens are open to follow simple guidelines to contribute to a scientific project, in the aim of creating a wide knowledge framework. Another emblematic experience in this field is NoiseTube.net: a research project, which aims at developing a new participative approach to noise pollution monitoring by involving the general public.

Traditional sampling measurements could be integrated with spontaneous contributions of citizens [3], capturing data with smart-phones applications, in order to cover non-sampled areas and periods. The final estimates would be produced through ex-post weight calibration and proper weighted averages of both structured and wiki components of the sample. It sounds complicated, but challenging, too.

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The main changes in the educational system since unity of the nation to the present

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Riassunto:

Nel processo di costruzione della nazione unitaria e poi nelle successive fasi di sviluppo e di crescita del paese, l'istruzione ha svolto un ruolo fondamentale, agendo sia come fattore di integrazione e promozione sociale sia come strumento di modernizzazione della nostra economia.
Nel lavoro si presentano i risultati di un'analisi dei principali cambiamenti intervenuti nel sistema di istruzione italiano a partire dall'Unità d'Italia fino ai giorni nostri. A tal fine si utilizzano i dati in serie storica inerenti la partecipazione al sistema educativo negli ultimi 150 anni, con particolare attenzione alle differenze di genere e alle peculiarità territoriali.

Keywords: education, school, university

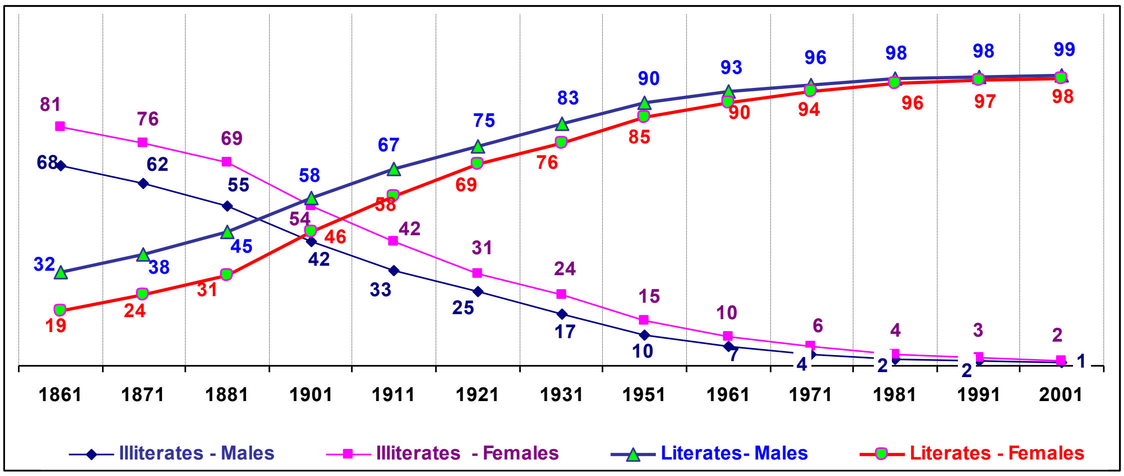
1. Aim of the paper, data and methods

In the process of nation-building unity and then in later stages of country's development and growth, education has played a key role, acting both as integration and social advancement factor and as a tool for modernization of economy.
The paper aims to present an analysis of the main changes in education from Italian unification to the present, based on time series data on participation in the educational system, with a special attention to gender and regional differences.

2. Results

The process of the Italian cultural development has grown steadily but slowly. At the beginning of our history unit, many generations ago, the 1861 General Population Census counted about 75% of illiterate Italians (not included Lazio and Veneto) aged

Literates and illiterates aged 6 or more, by sex (per 100 resident people) 1861-2001



more than 5 years. Italy was a country where, only 32 every 100 males aged 5 years or more were able in reading and writing, and among women only 19 out of 100 (furthermore, 98% of population was speaking only dialect).
Geographical differences were very strong and reflected the different social and economic realities of the new nation. The illiterate males of the south were 81%, whereas in the north-west were less than 46%. A similar inequality can be observed among women: if illiterates women in the north-west were the 62%, in the south the percentage reached 93%.

Looking at those who married in that time, in 1867 for example, 60 percent of grooms and 79% of brides could not sign the act of marriage not being able to read or write.

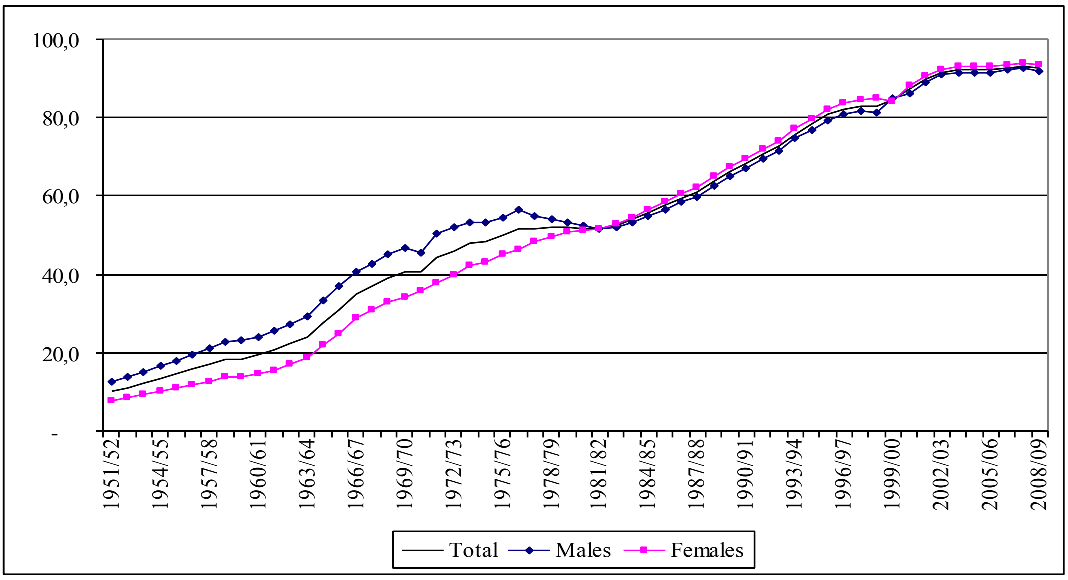
To improve educational level of population a new law (Coppino Act, 1877) fixed compulsory schooling at the age of 9 and established penalties for those who did not attend primary level school. Subsequently, at the end of the nineteenth century, enrolments at primary education began to grow; the increase constantly continued over time up until the end of the second World War, when full schooling at primary level (6-10 years old) was reached.

The Gentile reform (1923) extended compulsory education up to the age of 14, fostering participations in lower secondary school (from 1921 to 1941 the total secondary school enrolled students increased of 151%) . During the Fifties, after the end of the Second World War, lower secondary education has been increasing more and more, also due to the cultural climate of post-war reconstruction and the economic and social recovery. In 1962, a new reform (Act n. 1859) reordered and unified the lower cycle, confirming compulsory education to14 years and abolishing school tuition and fees. The main effect was a wider spread of schools all over the Italian territory together with a rise in the number of both male and female enrolments. This put the basis for the education and cultural growth of large part of population, previously excluded or kept to margins. In the middle of the Seventies, full schooling in lower secondary education was reached.

In upper secondary education, participation has significantly increased over the years: in 1951/52 there were only 10 out of 100 children enrolled in upper secondary schools.
The most striking growth rate of schooling is observed during the Fifties and Sixties, the latter characterized by the entry of the graduates from the reformed lower secondary schools. In the school year 2008/2009 there are 93 enrolled students for every 100 young people aged 14-18.

In particular, women's participation has a sharp increase: the enrolment rate for women, 7,7% in 1951/52, increased over the years up until the late seventies when it met the share of males; since then it has always been higher than the rate related to males. In 2008/2009 the female enrolment rate reached 93,5% (against 91,9% for men).
The geographical differences show rates higher than the national average (92,7%) in Central (96.8%) and in Southern regions (94.4%); on the contrary, for the northern regions the enrolment rate is lower (particularly, in the North-west the rate is 87,3%, more than five points below the national average).

Upper secondary school enrolments by sex - 1951/52 – 2008/09



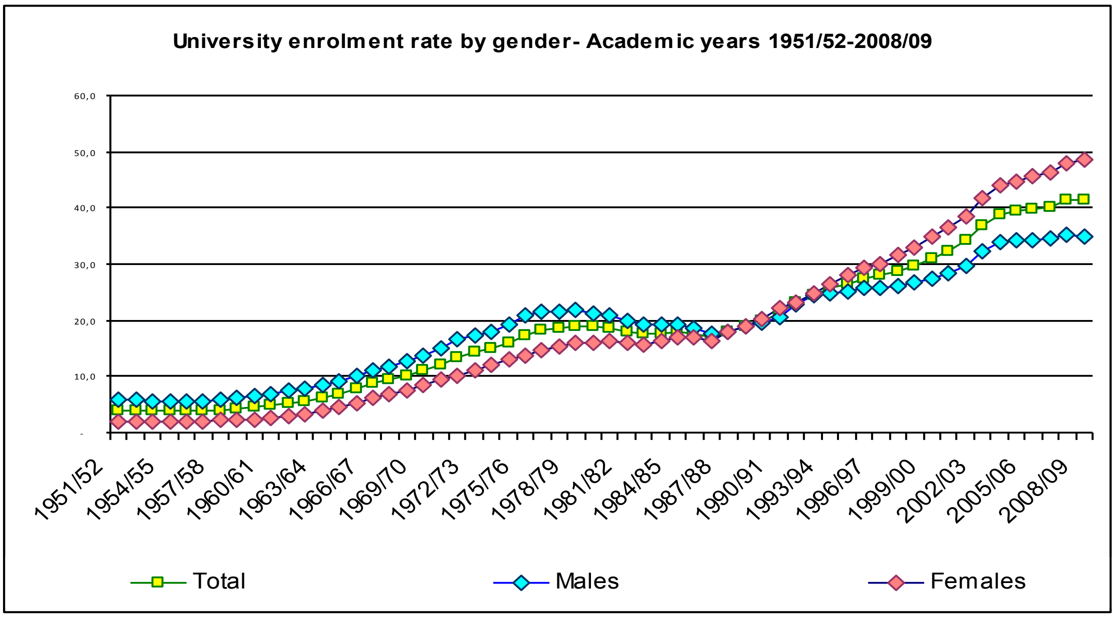
The increase in schooling has also had an immediate impact on the number of young people obtaining an upper secondary education diploma: in the school year 2008/2009 there were 73 graduates every 100 nineteen years old, about 36 more than thirty years before (and in 1950/51 there were less than 10 graduates for every 100 nineteen years old). Considering all types of schools, the attainment rates for females (78% of girls 19 years old) nowadays exceed those of males about ten percentage points.

With regard to university, since 1861 the participation has always been very limited. The most important changes occurred during the Sixties and the first half of the Seventies. In that period in Italy, as elsewhere in Europe, the number of enrolments recorded a strong growth, both as an effect of the increase in upper secondary education in the Fifties and Sixties and as a result of the liberalization of academic access. Codignola Law (1969) reformed the access requirements to university, allowing entry to all upper secondary graduates (i.e. holding any upper secondary diploma). So, Universities opened to a large proportion of young people who, coming from *vocational* upper secondary education, had always been excluded up to that time.
Consequently, in 1969, the percentage of new entry increased of 25,4% over the previous year (from 138.072 to 173.189) and the entry rate from upper secondary school to university arose from 53.4 to 61 per cent. In 1970/71 the entry rate was 75% for women and 97% for men. With economic growth and the changing needs of young, academic education has been changed from "elite university" into "mass university".

Thirty years later a new law, the Berlinguer reform (1999), has introduced significant changes in the university system. The new system, according to Bologna process, introduced two cycles: a first one lasting three years and the next one lasting two years ("3 +2"), each of which ends with the attainment of a university degree.

The new shorter paths to graduation have led to a new interest for academic studies: in 2001/02 new entrance (which had been stable for a long time, sometimes negative) are

331.288, increasing of 12.1%. in comparison with the previous year (when they were 295.526). For three years, new entrance and enrolments steadily increased. But, since the academic year 2004/2005, it has begun a new downturn that brought the number of new entrance in 2008/2009 to a level close to that found before the Reform.
Women took part in all the changing process even more intensely than men. The number of enrolments to 100 young people 19-25 years, which in 1951/52 amounted only to 2,1% for women *vs.* 5,8% for males, stood up for females up until 1989/90, when there was an overtaking by women who have, since then, always recorded higher levels than men. The arisen gap has grown over time and in the academic year 2008/2009 women enrolled in university are 48,5 out of 100 female 19-25-year old (34,9 out of 100 for males).



The enormous growth related to females also had an impact on the number of women getting an academic degree. The percentage of women in the total number of graduates, representing only 14,6% in 1926, increased over time up to the early Nineties when the graduates are divided exactly in half between men and women. In the following years the female share increases further and, in 2008, the graduates are made up of 58% women and 42% men.
Despite this undeniable progress, however, the gap with some major European countries is still large, especially with regard to university education. 150 years after the unification, Italy must make a further effort to reduce regional differences, still present, and to align with other EU countries into investment and growth of the national human capital.

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Response burden reduction through the use of administrative data and robust sampling

Maria Caterina Bramati

Abstract There are several reasons why robust regression techniques are useful tools in sampling design. First of all, when stratified samples are considered, one needs to deal with three main issues: the sample size, the strata bounds determination and the sample allocation in the strata. Since the target variable y, objective of the survey, is unknown, it is used some auxiliary information x known for the entire population from which the sample is drawn. Such information is helpful as it is strongly correlated with the target y, but of course some discrepancies between them may arise. The use of auxiliary information, combined with the choice of the appropriate statistical model to estimate the relationship with the variable of interest y, is crucial for the determination of the strata bounds, the size of the sample and the sampling rates according to a chosen precision level of the estimates, as it has been shown by Rivest (2002). Nevertheless, this regression-based approach is highly sensitive to the presence of contaminated data. Indeed, the influence of outlying observations in both y and x has an explosive impact on the variances with the effect of strong departures from the optimum sample allocation. Therefore, we expect increasing sample sizes in the strata, wrong allocation of sampling units in the strata and some errors in the strata bounds determination. Since the key tool for stratified sampling is the measure of scale of y conditional to the knowledge of some auxiliary x, a robust approach based on $S-$estimator of regression is proposed in this paper. The aim is to allow for robust sample size and strata bounds determination, together with the optimal sample allocation. To show the advantages of the proposed method, an empirical illustration is provided for Belgian business surveys in the sector of Construction. It is considered a skewed population framework, which is typical for businesses, with a stratified design with one *take-all* stratum and $L-1$ strata. Simulation results are also provided.

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1 Introduction

The presence of outliers can strongly bias the sampling design and hence the survey results. In particular, it could induce a wrong computation of the number of statistical units to sample, usually overestimating it.

In what follows we focus on the stratified sampling design, which has been proven to be the most efficient surveying technique under some basic assumptions (see Tillé, 2001) and it is currently in use at several NSIs for business surveys.

For instance, suppose that in the stratification variable X some outliers arise. Outliers are observations arbitrarily far from the majority of the data. They are often due to mistakes, like editing, measurement and observational errors. Intuitively, when outliers are present in a given stratum for the stratification variable X they affect both the location and scale measures for X. Therefore, it is clear that a higher dispersion than the 'true' one will be observed in that stratum.

Such a situation will bias the outcome of the HL method. For instance, the sample size would be bigger than it should be, given the fact that observations seem to be more distant (in average) than they are in the reality. Moreover, the strata bounds and the sample allocation would be both biased. This is clear when we consider the Neyman allocation, for example, which is based on within-stratum dispersion. Since the principle is to survey more units in the strata in which the auxiliary variable is more dispersed within the stratum, outliers might have the effect of increasing enormously and unduly the sample size in each stratum.

For this reason we build two robust versions of the HL method, the *naive robust* and the *robust* HL sampling strategy which we compare through a simulation study.

2 The problem

We focus on simple stratified samples with one take-all stratum and several take-some strata. This because we deal with

- skewed distributions (small number of units accounts for a large share of the study variables)
- availability of administrative information, providing a list of the statistical units of the target population (i.e. tax declaration, social security registers)
- survey burdens for firms and costs for NSIs
- data quality (administrative sources and survey collection)
- compliance requirements established by EUROSTAT

Now, it is known that there exists a discrepancy between the auxiliary variable X used for stratification and the survey variable Y. Therefore, the strategy suggested by Rivest (2002) is to recover such discrepancy by the use of a regression model.

Of course, the auxiliary information X is only a proxy for the target variable Y, which requires to estimate the *discrepancy* between Y and X, as suggested by Rivest (2002) with the *modified* HL algorithm.

In the business survey literature, the relationship existing between Y and X is often modeled by a log-linear regression relationship. Let X and Y be continuous random variables and $f(x), x \in R$ the density of X. The data $x_1, \ldots, x_N$ are considered as N independent realizations of the random variable X.

Since stratum h consists of the population units with an X-value in the interval $(b_{h-1}, b_h]$, the stratification process uses the values of $E(Y|b_h \geq X > b_{h-1})$ and $Var(Y|b_h \geq X > b_{h-1})$, the conditional mean and variance of Y given that the unit falls in stratum h, for $h = 1, \ldots, L-1$.

This model considers the regression relationship between Y and X expressed by

$$\log Y = \alpha + \beta_{log} \log X + \varepsilon,$$

where ε is assumed to be a 0-mean random variable, normally distributed with variance σ^2_{log} and independent from X, whereas α and β_{log} are the parameters to be estimated.

However this approach presents some weaknesses

1. s^2_{yh} is unknown, which makes crucial the use of the auxiliary information X
2. the number L of strata is selected by the user
3. the administrative records are often of low quality (errors)

We can distinguish three main sources of anomalies, listed below

- erroneous records in the surveyed data (Y) (**vertical outliers**)
- quality issues in the administrative registers (X) (**leverage**)
- outliers in both variables (X, Y) (good/bad **leverages**)

The presence of such anomalies makes unreliable the conditional mean and variance of $Y|X$, therefore affecting the sample size and strata bounds determination as well as the sample allocation.

In what follows we propose a possible alternatives to the Rivest (2002) modified HL algorithm. Strata bounds and sizes are derived minimizing the conditional variance in each stratum after a re-weighting of the information according to the degree of *outlyingness*. We refer to this approach as to the *robust modified HL* algorithm.

3 The Robust Modified HL algorithm

Supposing that a log-linear relationship exists between the survey variable Y and the auxiliary one X, then consider the S-estimator of regression as in Rousseeuw and Yohai (1984) as

$$S(x,y) = \arg\min_{\beta} s(r_1(\beta), ..., r_N(\beta))$$

where $r_i(\beta)$ are the regressions residuals and s is scale measure which solves

$$\frac{1}{N} \sum_{i=1}^{N} \rho\left(\frac{r_i(\beta)}{s}\right) = b$$

for a conveniently chosen ρ function and a constant b. This estimator is robust with respect to both vertical outliers and leverage points. Then, with some straightforward calculations (expanding $\rho(\cdot)$), the following approximation holds

$$Var[Y|b_h \geq X > b_{h-1}]e^{\sigma^2}\psi_h/W_h - (\phi_h/W_h)^2,$$

where

$$W_h = \int_{b_{h-1}}^{b_h} \omega(x^\beta)f(x)dx \tag{1}$$

$$\phi_h = \int_{b_{h-1}}^{b_h} x^\beta \omega(x^\beta)f(x)dx \tag{2}$$

$$\psi_h = \int_{b_{h-1}}^{b_h} x^{2\beta} \omega(x^\beta)f(x)dx, \tag{3}$$

β and σ are the parameters of the log-linear model in the previous section, and $\omega(x) = \rho'(x)/x$ is the weighting function.

The problem then reduces to solving for bounds $b_1,\dots,b_h,\dots,b_L$ which minimize n using the Neyman allocation scheme. In symbols, under the loglinear specification the objective function is

$$n_{\hat{t}_{ystrat}} = N_L + \frac{(\sum_{h=1}^{L-1}(e^{\sigma^2}\psi_h W_h - \phi_h^2)^{1/2})^2}{(c\sum x_i^\beta/N)^2 + \sum_{h=1}^{L-1}\frac{(e^{\sigma^2}\psi_h - \phi_h^2/W_h)}{N}} \tag{4}$$

where *robust* moments W_h, ϕ_h and ψ_h are those in 3, β and σ are the parameters of the log-linear model estimated by robust regression (S-estimator or LTS).

Then, the Sethi's iterations are run for a given L and precision c, computing the optimal strata bounds and sample size.

4 Simulation Study

The aim of the simulation study is to compare the performance of the two robust sampling strategies proposed in this paper with respect to Rivest (2002)'s based on classical LS regression.

Simulations are performed using the business sampling frame of the Structural Business Survey in 2002, where we consider as target variable (y) the value added of enterprises in the industry of *Constructions* which are stratified by the economic-size class. The number strata $h = 1,\dots,6$ is set according to the common practice in SBS, with one take-all stratum and 5 take-some strata. The auxiliary information x is on the turnover (from the VAT register). Then, population is generated from

$$\log y_i = \beta \log x_i + \varepsilon_i$$

with a choice of $\beta = .75$.

Then we consider the following designs

1. no outliers: $\varepsilon_i \sim \mathcal{N}(0,1)$
2. long-tailed errors: $\varepsilon_i \sim Cauchy_1$
3. long-tailed errors: $\varepsilon_i \sim t_3$
4. vertical outliers: $\delta\%$ of $\varepsilon_i \sim \mathcal{N}(5\sqrt{\chi^2_{1;0.99}}, 1.5)$
5. bad leverage points: $\delta\%$ of $\varepsilon_i \sim \mathcal{N}(10,10)$ and corresponding $X \sim \mathcal{N}(-10,10)$.

The contamination level, i.e. the percentage of outliers in the data, is set to $\delta = 15\%$ and 30%. Then the three procedures are used to compute the strata bounds, sizes and allocation

- generalized HL method (Rivest (2002))
- robust generalized HL method

at 1% precision and compared by means of relative MSE of the Horvitz-Thompson estimator for the mean. In the table below are displayed the main results.

Design	Relative Efficiency	Relative sample size
No outliers	0.10	100
Long-tailed Cauchy	0.00	0.29
Long-tailed t	0.08	10
Vertical outliers 15%	0.99	10
Leverage points 15%	0.00	10
Vertical outliers 30%	0.99	1.43
Leverage points 30%	0.00	1.43

Table 1 Summary of results comparing Robust modified HL method versus modified HL (Rivest, 2002), target precision: 1%

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Collaboration between Istat and INAIL to improve statistics availability within the Occupational Information System

Adelina Brusco, Simona Rosati and Pietro Scalisi

Abstract This work is concerned with the collaboration between Istat and INAIL for the project of the Occupational Information System. The aim of the System is to share different information from various sources for reconstructing social and economic context, in which occupations are developed. In order to facilitate users' access to the the Information System all data included in it need to be comparable. For this reason INAIL data have been subjected to statistical treatment to get occupation code according to the NUP and to correct item non-responses.

1 Introduction

Using administrative data for statistical purposes is becoming more and more important. Administrative sources provide large amount of data distributed all over the area, but often they suffer from shortcomings such as inconsistencies and missing values. It is well known that some variables are less reliable since they are not related to the purpose for which data are produced. This means that time-consuming methods and costs are required for ensuring good quality of data statistical treatment. A discussion of this subject can be found in the recent text by Anders and Britt Wallgren [7].

To our knowledge, research in quality improvement of administrative data is very scarce. Some authors chose to concentrate the attention on estimation strategies, which are considered more urgent than other questions [1]. As regards missing values and inconsistencies some studies tried to fill the gap by developing imputation rules in dependence on past or future information in a context of panel data [3]. More recent

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researches aimed to quantify quality of administrative data by using very reliable additional data source [6]. In our context neither of them was practicable; we made use of well-established statistical methodology of imputation for handling non-responses in administrative data.

2 The Occupational Information System

The project of Occupational Information System is born from the opportunity, facilitated by the recent developments of the web technology, to make available and well connect occupation data collected by a consistent group of public bodies.

The goal of the project is to share different information from various sources – both administrative and sample ones – for reconstructing social and economic context in which occupations are performed in the national labour market. Institutional bodies, that collect information on occupations, might participate to the Occupational Information System. The basic condition to enter the System is that occupation data are organized according to the current edition of the "Nomenclature and classification of occupations" (NUP; [4]): by means this standard all occupation data, which are made available from each body, are connected and shared in the Information System.

2.1 INAIL data

INAIL collects information related to occupational injuries occurred to workers who are covered by the national insurance. In the form of claim, which is filled in by employer, are included several information, such as modalities of injury event (where and how it is occurred), characteristics of injured worker (age, sex, occupation, professional status), information about company as well (e.g. code that identifies the relationship with INAIL and economic activity). Some information must be communicated obligatorily to INAIL in order to define risk, company, working and, above all, to start the administrative proceedings for any payment of accident. Other information is optional instead; one of these is either the occupation or work task.

The INAIL classification of occupations is different from the NUP because the reasons and purposes for which they have been realised are not similar. The INAIL classification is realised in order to analyse the risk, but sometimes it remains too generic for some jobs such as "administrative employee" and "operator". The NUP, which is based on the logic of the ISCO (International Standard Classification of Occupations), is a tool for organizing jobs into a clearly defined set of groups according to the tasks and duties undertaken (e.g. the NUP includes several medical specializations, while the INAIL classification distinguishes medical doctors who are exposed to radiations from those who are not).

Starting from July 2008 a new INAIL classification has been introduced that has merged similar jobs (e.g. service at the bar with bartender, or tourist operator with tourist guide) and has removed job items now obsolete or too much general (e.g. operator); it has also introduced other ones (e.g. pony express, operator assigned to the cut laser). From a statistical point of view the new classification has involved a break in time series due to new professions and abolition of some.

As mentioned above, information about occupation of injured worker is not mandatory; for this reason every year more than thirty percent of non-responses has been observed until 2008. In 2009 non-responses reduced to fourteen percent as a result of the classification adjustment.

3 The Method

The next paragraphs describe the procedure for imputing the NUP code to INAIL data. The procedure is structured in two steps: in the first one a set of deterministic rules is applied to match the code from the NUP with the corresponding INAIL one when if-condition is true; in the second step it needs to proceed through a probabilistic method of imputation when information is either missing or too generic.

The present study has been carried out on the basis of INAIL data collected in 2008. Further developments will be extended to the period 2007-2009.

3.1 Deterministic imputation

The first phase of the study has been dedicated to the deterministic encoding of data. Eight hundred fifty-eight items, used by INAIL to classify occupation of injured worker, have been analysed. Ninety-one percent of INAIL codes could be linked unambiguously to the corresponding NUP code. In the remaining cases, since the name of the job was too generic, the imputation has been addressed by additional information, such as economic activity, company size or type of accident at work. Thus, for instance, the “grinder” has determined two different codes according to economic activity: 6.1.3.2.2 – “Trimmers floor” – when it was associated with the activity of building completion (45.4), and 6.5.2.2.3 – “Workers in ebony” – when it was associated with the furniture production (36.1). When additional information was not sufficient to clarify possible outcomes of coding, a less detailed code (less than five digits) has been assigned (seven percent of the items). Only two percent of the items were too generic to be coded.

INAIL data translation process involved a training phase concerning the contents of the NUP and the analysis of occupations more subject to accidents. During this phase the set of deterministic rules was defined; as a result, the set of “donors” required for the following step of probabilistic encoding of non-responses was produced.

3.2 Probabilistic imputation

The imputation of item non-responses consists of a probabilistic procedure entirely based on the Fellegi and Holt methodology [2]. It is essentially made of a set of *edits* (rules) involving the occupation related variables. All records, that needed to be imputed, were processed by an algorithm implemented in SCIA, a System of Control and Automatic Imputation, completely designed by Istat [5].

Two strategies could be adopted: the first involves a "step by step" imputation of each single level of total or partial missing codes; the second aims to impute all together different levels of missing codes (e.g. records with partial code at first digit are imputed assigning them digits from the second to the fifth taking them from a donor at one time). For several reasons the present work is concerned with the first approach.

The proportion of records which have been imputed was rather high as shown in Table 1 (forty-three percent in 2008 considering partial and total missing). As a matter of fact, we were also able to ascertain the amount of records that will need to be imputed for each year (Table 1), even if, at present, probabilistic imputation was carried out only for data collected in 2008. We also observed that in 2009 the proportion of missing values was drastically reduced (eighteen percent), in consequence of the adoption of the new job description.

Table 1: Records per missing level of the NUP code (percent of values)

NUP code level	*2007*	*2008*	*2009*
Non-missing	49	57	69
Partial missing	17	14	13
Missing	34	29	18

4 Discussion

Probabilistic imputation revealed one main critical state: lack of variables (because they are often missing) correlated with occupation in a considerable number of records. This means that some figures could be too inflated by using imputation.

In order to increase supplementary information we propose to handle all together the three yearly data sets, as if they were one set. As a consequence we would expect significant reduction of possible bias effects due to imputation.

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An information system on personnel working in the health sector to support the planning and assessment of regional health systems

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Abstract An information system focussing on the personnel working in the public and private health sector has been set up by ISTAT in the frame of a project agreed with the Italian Ministry of Health (IMH). Through a wide review of the data sources and the integration of administrative and statistical data the information system provides a useful tool to the Ministry and the Regions to be used for planning and regional health systems assessment purposes. The data integration process allowed to bring the data to a "common language", to solve overlapping problems and to add new information, by the implementation of estimation methodologies too. The information system is based on Warehouse technologies and a web application allowing easy querying of the data. In addition to the pre-defined reports the user can implement customized reports that can be saved and exported. The system is equipped with metadata.

Keywords: *Health system, data warehousing, information system, personnel in the health sector*

1 Aims

This paper describes the information system focusing on the personnel working in the public and private health sector. This information system has been set up by ISTAT in the frame of a project agreed with the IMH.

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In Italy, information on human capital in the health sector is highly fragmented. Many sources [Cantù E., (2010)] provide heterogeneous data with regards to their collection, coverage and adopted classifications. In some cases data are affected by overlaps which do not allow to consider different data sets jointly without running the risk of creating duplications in the data. A complete picture of this phenomenon is therefore lacking.

The aim of the project was to produce for the first time statistical data on personnel working in the health sector through a wide review of the data sources and the integration of administrative and statistical data to provide a useful tool to the Ministry and the Regions to be used for planning and regional health systems assessment purposes [Chaloff, (2008)], [Commission of the European Communities, (2008)], [OECD, (2007)].

2 Data and Methods

In the project, an "ideal matrix" was conceived on the basis of the identified information needs. This matrix represents a schematization of the typology of statistical data which have to be produced. The analysis dimensions included in the matrix are: a) for the health facilities: typology, relationship with the National Health System, location (Region), institutional sector (public, private for profit, private no profit); b) for the personnel: type of the employment, typology of working hours, type of occupation, specialization (only for doctors), gender and age.

Each of the analytical dimensions indicated above develops along different hierarchical levels. The health facility and occupation dimensions represent the two core variables of the system, and ad hoc classifications were defined for them.

The health facility classification was based on the ICHA-HP International Classification of Health Accounts – Health Providers, which was adopted within the context of the System of Health Accounts [OECD, (2000)]. First-digit codes of this classification were used, while second- and third-digit codes were formulated to take account of specific aspects of the Italian health system.

The classification used for occupation has four digits and is the result of the combination of the informational needs expressed by the IMH, the project goal of providing detailed data and the informational potential of the data sources themselves. In this classification, the first digit distinguishes healthcare from non-healthcare roles; the 2nd digit distinguishes between medical and para-medical personnel, on the one hand, and personnel with occupational, technical or administrative roles on the other; for healthcare personnel, the 3rd and 4th digits reflect the details of medical specializations and non-medical healthcare qualifications.

As concerns the data sources, the activity of reviewing was carried out both in the sector of official statistics, exploring projects in the National Statistical Programme, and in the institutions, managing administrative archives. In addition, availability of other data not belonging to the official statistics was also checked.

Twenty one different data sources were identified, studied and analyzed but only a subset of these sources was selected for integration. The selection has been performed on the basis of the informational content, the data quality and the degree of integration with other sources. The selected sources provide data on: general practitioners and paediatrics; first aid physicians; personnel working in public administrations (Local Health Units and Independent Hospitals); personnel working in hospital facilities; practising physicians; physicians and dentists enrolled in the professional registry; personnel in rehabilitative centers and institutes; vital statistics for hospital facilities and for healthcare facilities (residential and outpatient); list of the institutional units in the Public Administration sector (S13); statistical register of businesses (ASIA).

The activity of data integration [Fellegi I. P., Sunter, A. B, (1969)] was particularly complex. It was necessary to draw a conceptual model that reconciled individual data (referred to individual professionals) with aggregated data (such as the number of persons working in a health facility), statistical data with administrative data.

The methodological approach required different phases to define the conceptual model and the data integration.

First, the universe of healthcare facilities was defined combining all the healthcare facilities registered by the IMH with other facilities found in the ISTAT archives. This step required a micro-level integration between the IMH lists and the ISTAT archives (S13, ASIA, other administrative archives).

Next, the data sources containing information on personnel working in the facilities identified in the previous step were selected.

During the data integration phase, these sources were “translated into a common language" by using the project classifications to code the variables for each analytical dimension. Problems with overlapping data (different sources providing data for the same units) were resolved and information gaps were identified (units with no personnel data, or personnel groups that were missing certain analytical dimensions).

A variety of estimation strategies were applied to compensate for certain information gaps. Those gaps were referred to: the distribution of Local Health Unit personnel into different health facility types (hospitals, residential facilities, outpatient facilities); the distribution of hospital physicians by specialization; the personnel working in private residential and outpatient facilities.

3 Results

The project delivered two main results: the integrated conceptual model with the related primary database, on the one hand, and the statistical information system on the other.

The integrated conceptual model and primary database are characterized by three distinct elements: 1) the health facilities that provide services to patients; 2) the businesses, non-profit and public institutions that operate in the healthcare sector and work through the health facilities, and 3) the individuals who work in health facilities. The database tables were constructed around these elements. The information on the personnel working in the health facilities is quantified into two measurement units: jobs (work contracts) and person-years (full-time equivalent units).

The second result concerns the generation of the statistical information system based on Warehouse technologies [Golfarelli M., Rizzi, S., (2005)], [Jarke M., Vassiliou, Y, (1997)] and a web application allowing easy querying of the data.

To facilitate consultation of the system, reports were prepared within four different topic areas: personnel working in public and private health facilities (general overview); Local Health Unit personnel; personnel of outpatient facilities; hospital physicians. In addition to the pre-defined reports described above, the user can implement customized reports (tables and graphs) that can be saved and exported.

The system is also equipped with the following metadata: methodological explanations, list of sources used for the integration, description of the analytical dimensions, description of the report structure, glossary and software user manual.

4 Conclusions

The results of this project have been very satisfactory: it was possible to build a comprehensive picture on personnel and at the same time to highlight some information gaps to be filled in the future by new surveys or new data sources.

As for the main information gaps, the data on the hospital sector (both public and private) is sufficiently complete, and the private for profit sector could eventually be integrated with ISTAT's ASIA archive. Despite the estimations that were made, the personnel data for residential facilities and outpatient facilities present significant shortcomings that are mostly attributable to the shortage of data sources on personnel for certain types of facilities registered with the Ministry. Private not accredited facilities that are not registered with the Ministry also require an extra effort, and the ASIA archive may represent a precious source from this perspective. Nevertheless, the task of individuating "eligible units", i.e., units classifiable as healthcare providers, is not an easy one and requires careful further investigation.

Lastly, the aggregated nature of the data provided by most of the sources represented a limitation, in that the integration procedure was particularly complicated and limited the potential benefits. In the future, greater integration opportunities and more information could be realized by drawing on individual data sources.

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Italian contributions on some recent research topics in cluster analysis

Daniela G. Calò

Abstract The paper presents a selective view of the issues that are attracting the interest of Italian statisticians working on clustering methods and applications. It does not aim at providing a comprehensive overview of the wealth of methods developed in Italy on the selected topics: indeed, it focuses on methods dealing with quantitative data and, in this context, only on the most recent literature. The fil rouge is given by the developments which have been inspired in quantitative data clustering by the complex nature of the data nowadays arising in a broad range of applications.

Key words: high-dimensionality, contamination, temporal data, non-standard data

1 Introduction

Cluster analysis methods are among the most known and commonly applied multivariate analysis techniques. Renewed stimulus in the development of novel clustering methods has been constantly promoted by the questions arising in their numerous application domains, at the interface with many different disciplines, including pattern recognition and engineering. In the last decades, the progress in data capture technologies and the growing capabilities in data collection have lead to new research directions. They have permitted the collection of huge amounts of increasingly larger and more complex data, thus rising the need of non-traditional statistical techniques for extracting relevant information. The development of adequate data analysis tools has attracted the interest of the statistical community, also in light of the parallel improvements in computational resources.

By taking the data-analytic challenges posed by modern data as a leading thread, this paper aims at providing a selective view of the main research lines currently

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followed by Italian statisticians in the field of quantitative data clustering. To this end, the presentation is organized as follows. Sections 2 and 3 refer to the traditional real-valued case by variable data matrix, and focus on the issues raised by high-dimensionality and by contaminating observations, respectively. In both sections, a separate discussion of the topic is given concerning the clustering approach based on Gaussian mixture models (GMMs), due to the prominent role this approach has gained in the literature as a sound statistical framework to cluster analysis. As an example of the problem of dealing with composite information, Section 4 focuses on time series clustering, which has lately emerged as an important research trend especially in data mining applications. Section 5 is devoted to some types of data that require specifically-designed clustering methods; in particular, it focuses on functional data and interval data, as these types of data seem to have most attracted the interest of Italian researchers in the last decade, also beyond the field of cluster analysis. Some final remarks are reported in Section 6.

2 High-dimensional data

In recent years, growing amounts of data are automatically recorded and stored in the form of high-dimensional observations: examples range from DNA microarray data, about the expression levels of thousands of genes observed on a number of sample tissues, to supermarket scanner data, pertaining to the products purchased by each customer. In high-dimensional settings, the clustering task is more difficult: the standard assumption that units within the same cluster are similar across all variables might be restrictive; the simultaneous use of all the observed variables may mask the effect of the variable subset that contains clustering information; finally, computational effort increases and interpretation becomes challenging with increasing dimensionality. Concerning Gaussian mixture-based clustering, the number of model parameters grows quadratically as the number of the variables, p, increases when component covariance matrices are not restricted; when p is large relative to the sample size, this may negatively affect the clustering performance of the model.

In order to cope with high-dimensional data, statistical methods that simultaneously perform clustering and dimensionality reduction have been actively investigated. A well known example, in a deterministic modeling approach, is Vichi and Kiers' factorial k-means [70]: it aims at simultaneously finding an optimal partitioning of the units and an optimal low-dimensional space by minimizing the within-cluster deviance of the projected data. In general, when using factor/component techniques, it may happen that some observed variables are correlated with several extracted dimensions, with possible complications in interpretation. In this respect, the factorial k-means idea of clustering units on a reduced space has been augmented by Vichi and Saporta [72] by adding the constraint that each spanning dimension is a linear combination of a disjoint set of variables only (more precisely, the linear combination with maximum variance). In this way interpretation is easier, because each variable can only be assigned to one of the extracted features, which leads to a simultaneous partitioning of the variables. Contribution [72] can also be seen as a special case in the class of two-mode clustering methods, *i.e.* the methods that perform clusterings of units and variables simultaneously.

Two-mode clustering is mainly applied in gene expression data, with the aim of identifying subsets of genes that exhibit similar expression patterns across subsets of tissues. More generally, it is applicable whenever the local association structures between the rows and the columns of the data matrix have to be discovered (see [64] for an overview on two-mode clustering, including methods implying nested or overlapping row-and-column clustering). In this research area, Rocci and Vichi [59] have proposed a generalization of the two-mode partitioning model known as double k-means [68]. While double k-means method specifies the same partition of the variables for each cluster of units (and vice-versa), Rocci and Vichi's method allows a different partition of the variables within each class of the partition of the units; by simply transposing the data matrix, the method can also be applied for discovering a variable partition with different groups of the units in each cluster of variables. Moreover, in text/web mining applications, where the data matrix entries denote the occurrence of a word in a document, Balbi *et al.* [6] propose a two-mode partitioning method for discovering groups of documents that are similar across different sets of words: the clustering solution is obtained by optimizing – via a genetic algorithm [10] – a specific index measuring predictability in contingency tables . Other developments may be found in the paper by Augugliaro and Mineo [4], which improves the performance of a two-mode partitioning algorithm by guiding the choice of the tuning parameters it depends on, and in the hierarchical mixture model proposed by Vicari and Alfò [67] for partitioning customers and products on the basis of purchase data, which includes customer- or product-specific covariates to model customers' choice probabilities.

A focus on GMM-based clustering. Mixtures of Factor Analyzers [45] (MFA) is a well-known approach to the problem of over-parameterization in GMMs. MFA assumes that, within each mixture component, the data are generated by an ordinary factor model. The number of parameters can be further reduced by using a global, rather than a local, latent variable model: by assuming a generative linear factor model, with independent common factors modeled as a finite mixture of q-variate ($q \ll p$) Gaussian densities, the observed variables turn out to be modelled as a GMM characterized by a parsimonious representation, in terms of both component mean vectors and component covariance matrices [47]. Along this research line, Montanari and Viroli [46] and Baek and McLachlan [5] have developed more flexible solutions admitting dependence among common factors. The potentialities of the method proposed in [46], named Heteroscedastic Factor Mixture Analysis (HFMA), have been explored along different directions: Galimberti *et al.* [26] have introduced a lasso penalization on factor loadings, so that variable selection is contextually performed; Calò and Viroli [13] have proposed a finite mixture model for clustering multilevel data, in which HFMA is assumed at the lower level of the hierarchy, thus relaxing the usual local independence assumption; by modelling each mixture component by HFMA, Viroli [73] has developed an extension of MFA to non-Gaussian factor analyzers.

The idea of using a component/factor technique to produce a partition of the variables (similarly to [72]) has been developed in the GMM framework by Martella *et al.* [41]. The paper is inspired by the ability of MFA to perform "local" dimension reduction through a different factor loading matrix in each mixture component. The Authors restrict the component-specific loading matrices to be binary and row stochastic, which implies that the component covariance matrices are block diagonal. Thus variable clustering is introduced in MFA, so that different variable partitions are discovered in the clusters of units identified by the mixture model.

A lately proposed approach to improve GMM performance is to include variable selection in the clustering algorithm [56, 44]. In Raftery and Dean [56] a stepwise algorithm is presented in which the decision of including/excluding a variable is taken by comparing the two models that are defined whether or not the assumption is made that the candidate variable is conditionally independent of the cluster membership given the so-far selected variables. Moving from the well-known criticisms of stepwise selection strategies, Scrucca [62] considers using genetic algorithms to search the model space for the best subset of variables. At this aim, the fitness value for a subset of variables is assessed by the BIC difference between two mixture models, one assuming some clustering structure and the other one assuming no clustering structure. Galimberti and Soffritti [27] exploit the approach in [56] as a formal framework in which to assess the identification of subsets of variables yielding different unit partitions. The Authors recast the problem of variable partitioning as one of model comparison, and propose a greedy search algorithm to explore the space of models. Thus, Raftery and Dean's method, that simply classifies the variables as informative or uninformative, is extended to the more complex setting in which multiple subsets of variables containing different group structures are present among observed variables, including the set of uninformative variables.

Data visualization Data visualization has gained a relevant role in many applications, thanks to modern graphic capabilities, as a valuable aid to explore and interpret high-dimensional data. Visualization purposes are the main motivation of the paper by Scrucca [63], which proposes a way to integrate dimension reduction into GMM-based clustering. Instead of imposing a latent variable model, the smallest subspace that captures most of clustering information contained in the data is searched for. The orthogonal spanning directions maximizing variation both in cluster means and in cluster covariances are identified using an eigendecomposition method.

New research efforts in data visualization are being inspired by the possible combination of visual interactive tools and data analysis techniques [52]. A recent contribution in this direction is given by Iodice D'Enza *et al.* [36] in the context of association rule mining (which can be viewed as a "mode seeking" clustering problem on a very high-dimensional sparse data matrix having sales transactions in the rows and all items sold in a store in the columns). The correspondence analysis-based strategy proposed in the paper aims at detecting the most potentially interesting items; the included graphical representations of the items help the user in focusing attention towards the most relevant content in output interpretation.

3 Contaminated data

Contaminating observations can derail most clustering methods and are very likely to occur in large data sets, possibly masking one another. It should be stressed that in a clustering perspective the term “contamination” concerns different sources of heterogeneity, that can occur simultaneously: it denotes not only observations that are distant from the bulk of the data but also unusual observations within the cluster. This has driven a special interest in robust clustering [28] and multivariate outlier detection (this distinction being elusive, since a relatively large group of outliers can be considered as a separate cluster, indeed). A main research line is represented by the Forward Search (FS) methods [57], *i.e.* the methods based on the strategy of sequentially fitting subsets of the data of increasing size. The FS provides a data-dependent flexible trimming, as it lets the data decide what is best, thus preserving robustness while ensuring high efficiency. Atkinson and Riani [3] have introduced a FS-based method for exploratory cluster analysis. It provides a variety of informative plots that allow to tackle both the problem of robust clustering (with a data-driven assessment of the true number of clusters) and that of outlier identification at the same time. Farcomeni [25] has resorted to the FS in devising a method for coping with contamination in the class of double k-means methods. He presents a two-mode extension of the trimmed k-means procedure, with a FS-based selection of the amount of trimming. The proposed method inherits from FS the benefit of robustly estimating cluster centroids while performing outlier detection.

A focus on GMM-based clustering. When the number of mixture components is treated as fixed, a small proportion of outliers can dramatically affect ML estimates, as well as the corresponding clustering. Two main solutions were proposed in the literature: Banfield and Raftery [8] suggested to add a “noise component”, modeled as a uniform density on the convex hull of the data; Peel and McLachlan [53] considered using mixtures of multivariate t densities. Since the appearance of this latter paper, mixtures of multivariate t-distributions are becoming more and more popular [45]. This motivated Greselin and Ingrassia [30] in theoretically investigating the class of mixtures of multivariate elliptical distributions with respect to the problem of likelihood maximization; concerning t-mixture estimation, they propose an algorithm performing likelihood maximization in constrained parameter spaces.

Concerning Banfield and Raftery’s method, Hennig [32] proposed a variant for one-dimensional data, which has better breakdown performance than both [8] and [53]: it consists in replacing the uniform distribution with a non negative constant c over the whole real line. Coretto and Hennig [18] have developed a procedure for a data-driven specification of the constant c. The same Authors [19] have theoretically investigated the approach [8] in the one-dimensional setting. They show that it does not necessarily define the (global) ML estimator for the assumed model, neither it defines a consistent estimator. As an alternative, they introduce a model consisting of a mixture of uniform and Gaussian components and define a constrained ML estimator, which is shown to exist and to be strongly consistent. For the case of a single uniform component, an algorithm for constrained ML is derived.

In GMM-based clustering, when shifting from the idea of contamination in cluster distribution to the more general concept of "deviation from normality", the problem remains that more components (than clusters) are needed to capture any deviation. Different solutions have been recently proposed in the literature. Asymmetry (or both asymmetry and outliers) in cluster distribution can be handled by fitting mixtures of multivariate skew-normal (or skew-*t*) densities [38, 74]. Another way to enable the number of components to correspond to the number of clusters is to merge the Gaussian components that are not sufficiently separated to be interpreted as clusters [12, 33, 58]. A similar idea is to assume that each cluster is well-modeled by a Gaussian mixture, as proposed by Bartolucci [11] in a one-dimensional setting; the contribution of Viroli [73] can be also viewed in this latter framework.

4 Temporal data

Temporal data arise in many application fields, ranging from time-course gene expression analysis to electricity consumption monitoring [29]. When dealing with the problem of grouping similar time series, the clustering task is made more complicated by the fact that conventional dissimilarity measures ignore the dynamic structure of the series and are sensitive to possible distorsion in time axis [16]. Moreover, in the case of multivariate time series, data have the form of a "three-way" array; a review on dissimilarity indexes between multivariate time series can be found in Baragona [9]. In this Section, Italian contributions in clustering discrete-time series are distinguished according to the way the concept of dissimilarity between time series is established (reference is made to univariate series unless otherwise stated); contributions in longitudinal data analysis are mentioned, as well. The case of continuously varying time points is considered in Section 5.

Model-based approach. The observed series are assumed to be generated by some time series model and time trajectories are compared according to the properties of the respective underlying stochastic processes. In this framework, the idea, proposed by Piccolo [54], of evaluating the dissimilarity between two ARIMA models by the Euclidean distance between the coefficients of their $AR(\infty)$ representation has inspired numerous developments, as reviewed in [17]: more recently, Corduas and Piccolo [17] propose a partitive clustering algorithm in the class of invertible ARIMA processes; Otranto [50] adapts the idea of comparing autoregressive approximations to the problem of identifying clusters of series with homogeneous volatility within the class of GARCH models; a further extension to a class of multivariate GARCH models is given by Otranto [51], who presents an agglomerative algorithm for automatic detection of groups of multivariate series having homogeneous correlation dynamics. Alternatively, De Gregorio and Iacus [21] propose a nonparametric distance in a situation where observed data form a Markov process. By adopting an orthonormal basis estimator of the transition operator of the process, a distance between two series is established by comparing the corresponding basis coefficient estimates.

Raw-data based approach. In this framework, dissimilarity measures are defined directly on raw series data rather than on the corresponding model-based representations. A recent example is given by Coppi *et al.* [14], where the problem of clustering a set of spatial units on the basis of their multivariate time trajectories is tackled. Two solutions in a fuzzy k-means approach are proposed, depending on wether a cross-sectional or a longitudinal analysis is preferred. In the former, the emphasis is on the comparison of the static multivariate characteristics of the units; therefore, dissimilarity is assessed by a synthesis (over time) of the squared Euclidean distances between units in the variable space. In the latter, individual multivariate histories are compared according to the rate of change in position; hence, dissimilarity is assessed by a synthesis (over time) of the squared Euclidean distances between lag 1 difference vectors. A penalization term is also introduced in the fuzzy k-means loss function in order to take into account the spatial nature of the statistical units. The longitudinal and cross-sectional approaches to multivariate time series clustering are currently being pursued further by Vichi [69]. In the former approach, a dissimilarity measure (comparing trajectories also in terms of their slope and concavity/convexity) is introduced and used to fit a clustering model for three-way data. This model identifies the optimal partition of the units while simultaneously reducing the original multivariate space by a factorial approach, so that the trajectories can be visualized in a low-dimensional space. On the cross-sectional side, a method is presented that assumes a k-means clustering model for each time and a vector autoregressive model for the dynamic evolution of each cluster centroid. Thus, homogeneous clusters can be identified for each time occasion and the dynamic evolution of their centroids can be studied; this offers a combined perspective aiming at discovering patterns of evolving patterns.

Feature-based approach. A further approach is motivated by the fact that high dimensionality (*i.e.* the large number of time points) can blur the clustering structure and slow down the clustering algorithm. It consists in measuring dissimilarity on some lower dimensional features that capture the dynamic structure of the data. In the fuzzy k-means framework, D'Urso and Maharaj [24] and Maharaj *et al.* [40] consider the following features, respectively: the estimated autocorrelation coefficients for different time lags (under the stationarity assumption), and the estimated wavelet variances associated with the different frequency bands the series is decomposed into (when one aims at distinguishing among different variability patterns). In the same fuzzy context, Maharaj and D'Urso [39] propose a feature-based comparison in the frequency domain, which consists in representing a stationary time series by its estimated cepstrum, *i.e.* the spectrum of the logarithm of the spectrum.

Hidden Markov Models. New methods for classifying individuals according to the evolution of a latent individual characteristic of interest have been developed in the framework of Hidden Markov Models (HMMs) for longitudinal data [66]. Maruotti and Ryden [43] have considered HMMs for longitudinal count data, with Poisson distributions in the conditional part of the hidden Markov model: besides including covariates in the generalized linear predictor modeling the Poisson parameter, they add individual-specific random effects in order to account for the unobserved individual heterogeneity not captured by the available covariates. Since the ML estimate of the random term distribution, which is left unspecified, is given by a discrete distribution, their approach yields a finite mixture of homogeneous HMMs. Concerning non-homogeneous HMMs, Maruotti and Rocci [42] adopt an analogous parametrization for the hidden part of the model (*i.e.* in the transition probabilities among the Markov model latent states); following the same nonparametric ML approach described above, they show that a finite mixture of non-homogeneous HMMs is obtained. Mixtures of HMMs have been applied in different research fields: an interesting example is given in De Angelis [20], where model [66] is applied to the study of the poverty phenomenon in Italy, providing insights both on its dynamic behavior through time and on its heterogeneity among Italian households.

5 Non-standard data

Research efforts are being attracted also by the analysis of specific types of data, whose nature requires that specifically-designed methods are defined. In particular, active research lines are devoted to uncertainty-affected data and functional data.

Uncertainty-affected data. The classical representation of a statistical unit by means of a single (crisp) value of the considered feature may be indeed reductive or inconsistent in case of imprecision or vagueness of the observed feature. Common ways to describe the uncertainty affecting observed values is to represent the data by means of fuzzy numbers or intervals of real values. Along these two approaches, examples of recent contributions in cluster analysis include Coppi *et al.* [15] and Irpino and Verde [37], respectively. Coppi *et al.* define a new dissimilarity measure for a general class of fuzzy data, and introduce two clustering techniques (both dealing with a further source of uncertainty, *i.e.* the one pertaining to cluster assignment). Irpino and Verde propose a distance measure for interval (or set-valued) data, each interval being assumed to be the support of a uniform distribution, and employ it as an inertia criterion in a classical iterative partitioning algorithm for cluster analysis.

Other complex data formats arise in database manipulation and synthesis. An example is the notion of "histogram-valued" variable, which aims at preserving distributive information when the values of a variable in a database are aggregated over a set of lower-level individual observations in order to extract useful information. The analysis of intervals, histograms and other complex data accounting for variability has attracted a great deal of interest in Italy in the last decades (see the references in [23]). In particular, as far as clustering problems are concerned, Verde and Irpino [65] have introduced a distance measure between histograms, which can be employed in association with partitioning methods as it satisfies the decomposition property in "between-clusters" and "within-clusters" components.

Functional data. In functional data analysis, the observation is given by the values of a smooth random function, measured (with error) on a fine discrete grid: examples are earthquake waveforms [1] and the surfaces obtained by modern image analysis tools. On these data, smooth function estimation is usually performed by means of Fourier or B-spline basis functions; examples of alternative estimation approaches can be found in [55] and [22]. A problem peculiar to functional data is curve misalignment, which can act as a confounding factor when trying to cluster the curves [48]. To avoid this risk, Sangalli *et al.* [61] propose a procedure that simultaneously performs clustering and alignment on a set of n functional data. The aim is to find k template curves, one for each cluster, and n aligning functions such that the overall similarity between each aligned curve and the most similar template curve is maximized: this optimization problem is tackled through a k-means-like algorithm alternating template estimation steps and alignment-assignment steps. Moreover, clustering applications on geographically referenced functional data (like meteorological data recorded over a period by sensors located in different sites) create the need for methods that take spatial dependence among the curves into account. In this context, Romano *et al.* [60] are exploring how the spatially constrained clustering methods proposed in the literature can be integrated in the functional framework.

6 Final remarks

The leading thread followed in the paper forced us to leave aside contributions concerning specific problems in the selected topics. It is the case of GMM likelihood unboundedness, which has been deeply studied by Ingrassia and Rocci [35]. In light of the results obtained on the convergence behaviour of the EM algorithm towards degeneracy, they have observed that the risk of unboundedness can be prevented by putting a numerical constraint in EM iterations: the specification of this constraint does not require any a priori information about mixture components, unlike what happens in other methods already presented in the literature [34].

Other types of non-standard and complex data with relevant clustering applications could have been mentioned as well. It is the case of dissimilarity data matrices, which represent complex objects describing different classification structures of a set of units. The issue of partitioning a set of dissimilarity matrices (concerning the same set of units) into homogeneous clusters has been addressed by Vicari and Vichi [71]; the same idea of classification comparison has motivated Morlini and Zani [49] in studying an index for comparing two hierarchical clusterings. Another example is image segmentation, which has inspired the contribution by Alfò *et al.* [2] on the use of a spatial model for the cluster membership process in a finite mixture on geographical units. Furthermore, it should be mentioned the case of the highly evolving multiple streams of data emerging on the web or in financial applications, which are the object of ongoing research by Balzanella *et al.* [7] on incremental clustering methods. These brief final notes only serve to remark that the challenges posed by the data nowadays arising in an increasingly wider range of domains are one of the main drivers of new developments in cluster analysis and, more generally, in data analysis. It is reasonable to expect this trend will continue in the future since, as John Tukey is reported as having said, “the best thing about being a statistician is that you get to play in everyone’s back yard” [31].

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The Italian contribution to the origins of statistical cooperation (1853-1920)

Laura Camastra

Abstract The present paper gives an account of the Italian contribution to one of the oldest forms of organised contact between scientific workers beyond national borders: the international cooperation of statisticians. The first example is the International Statistical Congress, first called in Brussels in 1853, that is before the Italian unification in 1861. The second and most prominent one is the International Statistical Institute whose founder member and successively President was Luigi Bodio. The paper intends to provide a synthetic description of their origins, organisation and achievements with a specific focus on the Italian contribution pre and after the unification of Italy.
Key Words: International, Statistics, cooperation, Luigi Bodio, contribution.

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The contribution of Italian statisticians to the International Statistical Congress

The idea of estabilishing organised contacts between the statisticians of different countries explicitly arose during the middle of the XIX century. The first half of the century was caractherised by an explosive industrial development in Europe and questions related to the socio-economic situations in the different countries started to become more and more frequent. The need to get together and exchange knowledge and experience was expressed for the first time in England, at the Universal Exhibition held in London in 1851.To this respect it is worthwhile mentioning that it was an Italian, Leone Levi[2], who suggested to reorganise all European statistical studies under common rules. Levi's ideas, in agreement with those of two prominent Belgian statisticians, Quételet and Visschers, helped promoting the organisation of a Statistical Congress to be hold two years later.

1.1.1 The participation to the first sessions of the Congress

The first session of the Congress took place in Bruxelles in 1853 and Italians were finally able to participate and meet with other foreign colleagues. Nevertheless, despite the fact that several attempts had been made to produce and present together statistics of the various Italian States[3], none of them could be mentioned and discussed during the Congress. Only two scholars were able to attend the meetings: Bertini, delegate from Piemonte, and as a representative of Austria, the abbé Nardi. The "Atlante geografico, fisico, storico del Granducato di Toscana" written by Zuccagni.-Orlandini could not be discussed too, even if it probably represented the most important contribution to the Congress before the Italian unification. In order to draft his Atlas and his "Corografia d'Italia" the author personally travelled throughout the country without informing the different States he visited before his work was completed. The Italian contribution to the second and third sessions of the International Statistical Congress (hereinafter ISC) was still limited. The second session of ISC took place in Paris in 1855. Italian participants increased to nine, including Bertini and Nardi. To the third session held in Vienna in 1857 also Zuccagni-Orlandini participated. To the fourth session of the Congress, held in London in 1860, Italy did not participate at all, being completely absorbed in the unification process[4].

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[2] Leone Levi founded the first Chamber of Commerce in England.. Giusti (1926-IV-1936-XIV. p. 148).

[3]Among them is the work of Serristori "Saggio di un Atlante statistico dell'Italia",,modified and updated becoming in 1842 "Statistica dell'Italia nel 1842" in which all data were presented together, distincted by State, or the "Annuario economico statistico dell'Italia" by Maestri, political refugee in Piemonte who clearly expressed the concept of connecting his research to a nationalistic purpose combining the statistical opportunity to a patriotic act (U. Giusti, Op. cit. pp. 145-147).

[4] Giusti (Op.cit. p. 147-151).

1.1.2 The Italian contribution after the unification of Italy

Italy could participate as a unitary State at the V session of the ISC, which took place in Berlin in 1863. On that occasion Maestri and Correnti reported on the arrangement given to the Statistical Directorate of the new Kingdom of Italy and on the work carried out, in particular with reference to the successful implementation of the general Census of the Italian population carried out in 1861 which costed only 640.000 Liras, that is one tenth of what had been spent for the United Kingdom. The VI session of the Congress was held in Florence in 1867 and was a great success for the results achieved. The topics discussed included virtually all aspects of the public administration and Italians contributed in many different fields such as statistical methodology, agriculture, financial, military and education statistics. At the occasion of the VII session in The Hague in 1869 it was decided to publish a volume of comparative international statistics. It was proposed to divide the work called "La Statistique Internationale de l'Europe" amongst the most important European States. Italy was assigned topics on thrift institutions and public assistance. At the VIII session held in Petersburg in 1872 Bodio participated as delegate of the Italian Government following Maestri's death. Due to the uncertainty in the leadership of the Italian statistical office followed by his death Bodio had to declare that the topics assigned to Italy during the previous session could not be carried out. Other countries were however in the same position, therefore for the time being, Engel's project was bound to fail. Finally, the IX and last session of the Congress took place in Budapest in 1876. Bodio reported on the issue of which kind of population was to take into consideration as a basis for the calculation of mortality tables. Italians contributed also to discussions on trade statistics and the judicial register.

The end of the ISC and the origins of the International Statistical Institute

The end of the ISC was primarily due to serious problems in its organisational structure. Too many subjects were covered in a limited period of time. Additional reasons for the breakdown of the Congress were the lack of aids to facilitate discussion such as simultaneous interpretation[5]. It was necessary to wait until 1885 before the representatives of statistical studies all over the world could establish a new free and independent Institution where they could gather again to attain uniformity in the compilation of statistics between different countries. The opportunity came on the occasion of the 50th anniversary meeting of the Statistical Society of London, held in June 1885. It was suggested to include in the subjects of discussion a proposal to establish an International Statistical Society. The "constituent meeting" of the Institute was held in London. In the years 1876-1887 Italian statistics headed by Bodio, raised to such a high and respected position in the international statistical community that, when the International Statistical Institute (hereinafter ISI) was set up, Bodio was acclaimed as Secretary General. In addition, it was decided to accept the invitation of the Italian government to hold the first session in Rome, which actually happened in 1887.

[5] Nixon (1960, p. 10).

1.1.3 The role played by Bodio in the creation and development of the International Statistical Institute

The first issues of the *Bulletin* published by ISI were almost entirely the result of Bodio's efforts as regards the number and importance of Italian essays. They focused on international statistics on the population movements and causes of death and migration, all committed to the Italian Statistical Directorate headed by Bodio[6]. He was Secretary General for 20 years, resigning in 1905 when he left his post of General Director of Italian Statistics to become a member of the Council of State. In the same year he was elected as honorary Secretary General and soon after, in 1909, he was unanimously elected as President of the ISI, position he kept until his death, in 1920[7]. One of his most important achievements was the initiative of developing international Statistics on Migration. Bodio always kept frequent contacts with the most eminent statisticians, among them were Quetelet, Lévasseur, Engel, Wagner, Methorst[8], and his opinions were taken in such a high consideration that he not only could influence the admission of new members in international scientific associations but played a pivotal role in laying down the foundations of statistical research at international level. In 1913 he also contributed to the creation of the Permanent Office for the purposes of publishing the already mentioned "International Statistical Yearbook", of maintaining a library, of keeping Institute's archives and of preparing the programmes of the ISI's sessions. World War I caused a serious stop in the activities of the ISI. Following the war and few days before he died Bodio participated in the first meeting of the International Statistical Commission set up by the new international body, the League of Nations, which took place in Paris in October 1920. Bodio was appointed Chairman of this Commission and in his speech he defended the role played by the ISI, strongly advocated for the creation of an independent body, entirely free of political influences and able to offer the guarantees of competence, independence and impartiality on statistical matters.

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Visualization and storytelling of statistical data. A dynamic and interactive approach

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Abstract The availability and accessibility of official statistics plays a fundamental role in our society. In this view the National Institute of Statistics (Istat) proposed a new product, "*Noi Italia – 100 indicators to understand Italy*", that represents an innovative product both from statistical and technological point of view. 120 statistical indicators referring to 19 themes, related to economic, social, demographic and environmental fields, have been calculated starting from basic data, coming from different sources, and have been presented through a Web application based on a GeoAnalytic Visualization tool, STATISTICS EXPLORER. The work is very important also in perspective of the celebrations for the 150th anniversary of Italian Unification, because it gives users the possibility of tracking various phenomena over time.

1 An overview of "Noi Italia"

The Istat new product "*Noi Italia – 100 indicators to understand Italy*", according to the principle of accessibility and clarity called from Code of Practice for European statistics, is a smart tool for official statistics data dissemination.
Noi Italia represents an innovative product both from technological and statistical point of view: advantage of the latest trends and developments, especially in the areas of the Web technologies, are fully exploited to enrich the interactive mode of use of data, moreover an integrated statistical overview is given for many topics. 120 statistical indicators have been calculated starting from basic data, coming from different sources and referring to 19 themes, ranging from economic, social, demographic and

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environmental fields, giving users the possibility to understand the most important positive and negative aspects of the country in which they live, comparing the national position with that of other European countries and highlighting regional differences in the Italian national context.

Indicators have been selected firstly considering the main targets defined in Lisbon strategy heavily based on economic concepts. Secondly, the indicators considered in the Community Support Framework have been included in order to analyse a development pathway and to reduce social hardship for the Italian south regions. Finally, all the indicators allow the comparison at European and Nuts2 level. Due to lack of indicator database, they have been calculated starting from basic data, coming from different sources.

Metadata are provided together with each indicator explaining clearly and simply the institutions that collect data and the reference survey, the mainly publications and some hyperlinks that enable users to better analyse further aspects related to the indicators. A specific section is devoted to the description of how those statistics were calculated, what they mean, the existing reference legislation if defined and the unit of measurement considered.

The Web site http://noi-italia.istat.it gives also the possibility to download tables and graphs. These objects are divided in three areas: the first one contains all graphs and tables related to European comparison, the second presents graphs, tables for Nuts2 level comparison within the Italian territory, together with a map related to the last available data. The third area refers to time series indicators related to the Nuts2 level.

The dynamic graphical visualization allows users to have an immediately and clear view of how the phenomena changed over the time. The Web page layout for an indicator (Municipal waste collected) is illustrated in Figure 1.

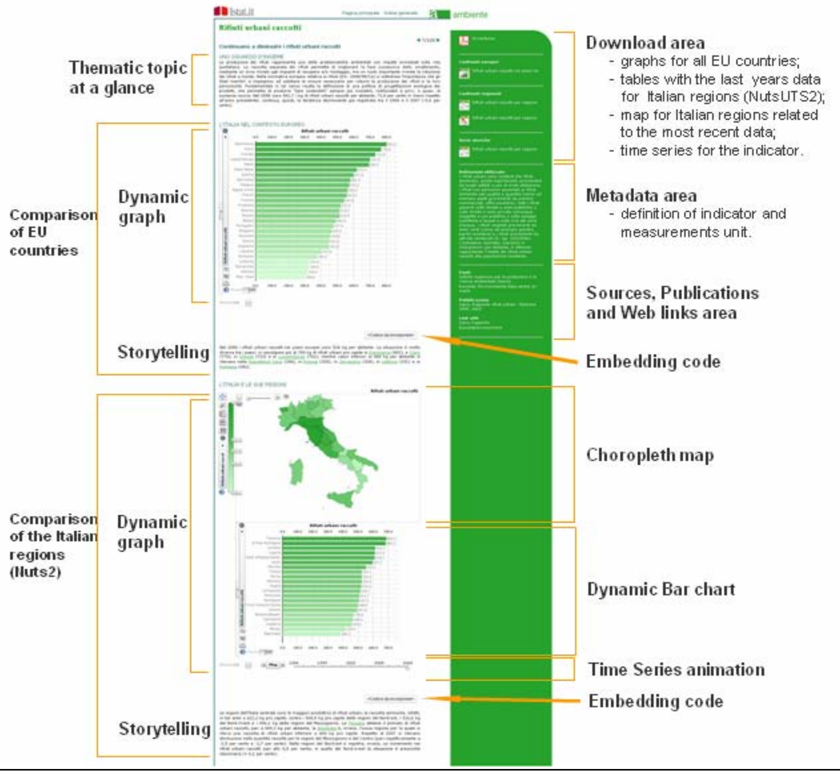
2 New tools for data visualization

With reference to technological point of view of *Noi Italia*, a version as digital book has been released, through a Web application based on a GeoAnalytic Visualization tool, STATISTICS EXPLORER. It has been developed by the Swedish research center NcomVA, localized in Italian language and fitted to the purposes of *Noi Italia*. The tool takes full advantages of the latest trends and developments in the area of Web technologies and storytelling. Furthermore, a powerful and innovative data visualisation component (vislet eXplorer), based on widget technologies, offers a set of dynamic object enabling users to manage time series analysis, European comparisons, quick selection of territorial areas to which indicators are referred. Moreover, the online solution offers the possibility to link the graphical visualization of spatio-temporal data with free texts and share such a model with other users. The combination of dynamic graphs with interactive texts represents an effectiveness way to make sense to social and economic phenomena and explain them to the users. For all these reasons, it undoubtedly represents a meaningful step to turn data into knowledge.

The main processes to produce the dynamic object (vislet) are: production of preliminary dataset, production of files in specific xml formats and integration of vislet in a distributed Web environment.

As regards production of dataset, the main difficulty has been to collect data from several sources in different file format and integrate them with the given Statistics eXplorer data structure. We decided to implement a semi-automated process that could involve all the Istat data production departments, distributing the workload to collect the data, and use a well known common tool that could easily automatize the needed transformation of data. Excel file format was the chosen environment for data coming from the Istat data production departments. Some macros, in Visual Basic for Application, have been implemented to offer a very flexible front-end to input the required information needed to process the different Excel files and to output the Unicode .txt files needed by Statistics eXplorer.

Figure 1 - An example of the Web page layout for the indicator "Municipal waste collected"

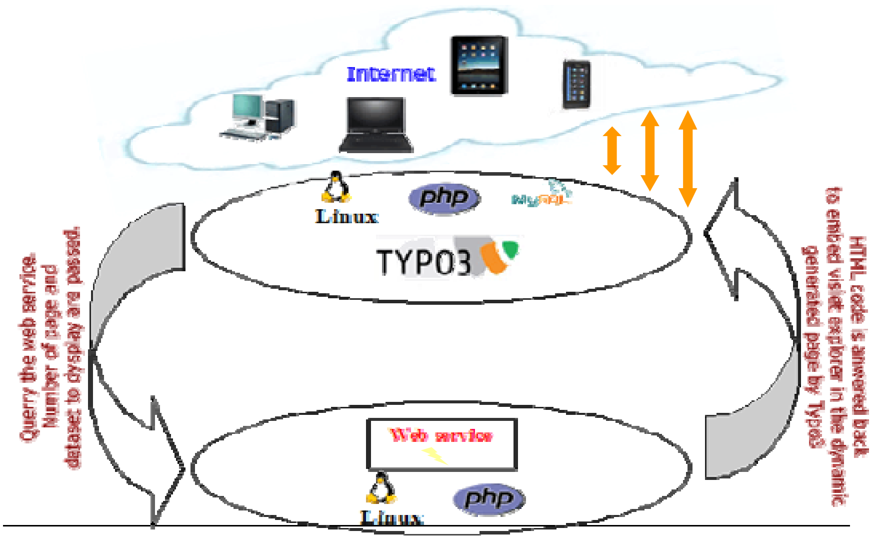


The production of vislets needs two components: the Flash application realised by NcomVA using Flex technology and the xml file containing both the dataset, that the graph represents, and the story, that explains the graph. Because the online publication is composed by more then 200 vislets, we needed to produce more then 200 xml files. In order to achieve the goal in a short time, we had a strong need to standardize and automate the process production. For this purpose we implemented an application (in Visual Basic) offering us a very user-friendly front-end to produce the xml file. The application allowed us to set easily the parameter for the two main graphic components used in *Noi Italia 2011* (Map and Histogram) according to: the default indicators chosen to be displayed; features that we offered to the end user through the application; the layout specification (colour scheme, character style) given by the Istat communication management for each section. Moreover, the application automatically integrates the dataset, that was transformed in the previous stage, into the output xml files, and creates in the stories the hypertext links, for a set of given keywords, necessary to show in the graph particular aspects of the indicator.

With reference to the Integration of vislets in a distribuited Web environment, the Online Publication *Noi Italia 2011* was realized with Typo3 Content Management System. In order to dynamically integrate the vislet eXplorer in the Typo3 environment without hard coding the parameter to embed the vislets in more then 200 pages, a web service has been implemented.

The web service is remotely queried by Typo3 and it answers back providing the html code necessary to embed the appropriate vislets for each page and for different datasets. Moreover, the web service provides the code to be furnished to the end users, allowing them to distribute the single vislet in any other web environment (blog, email, static html page or dynamically generated web page). The Web infrastructure used in *Noi Italia 2011* is shown in Figure 2.

Figure 2 – *Noi Italia 2011* Web infrastructure



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Population Censuses between Tradition and Innovation: The Drivers of Change around the World

Giancarlo Carbonetti, Luca Mancini, Luigi Marcone[1]

Abstract The need for more timely and better quality data coupled with nonnegotiable budget constraints has urged National Statistics Institutes around the world to take steps towards reforming population censuses. A growing number of countries, including Italy, have decided to move away from a traditional census approach heavily reliant on the role of enumerators toward a mixed strategy combining traditional enumeration with information from population registers.

1. Introduction

All nation states face the necessity of knowing how many people live within their geographical borders, along with information on their age composition, gender divide, level of education, occupation, economic activity and housing conditions just to mention a few. This knowledge is crucial in order to conceive and implement a vast array of public policies including schooling, employment, housing, health, pensions and others.The distinguishing features of a population census are the attempt to count each and every person living permanently on the fatherland, the simultaneity of the collection process across the territory and its cyclical recurrence usually punctuated by 10-year time lags. The population census is therefore the ‘mother’ of all of socio-economic surveys to which they all refer and from which they all draw legitimacy and methodological rigor. Not to mention the quintessential political implications of the census outcomes in those countries where, by constitution, census population counts are

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used to define constituencies or to assign parliamentary seats both at the local and national level. There is a spectrum of census-taking strategies which comply with a population census' constituent elements of universality, simultaneity and periodicity. For instance, individuals can be either counted on the basis of the returned questionnaires or through the use of administrative registers or by the former and latter combined. Likewise, universality does not rule out the use of sampling in some areas and/or for a subset of characteristics of the individual or the dwelling. Moreover, universality and simultaneity do not prevent to devise a rolling census like in France where data are collected every year in different census areas and national results are averaged out and published every five years. The rest of the paper is organized as follows. Section 2 classifies the census strategies adopted for the 2010-2011 round by 35[2] countries and outlines the main changes with respect to the last round conducted in 2000-2001. Section 3 tries to identify the main factors influencing the decision to stick to a certain strategy or to make the transition to an alternative approach. Section 4 concludes.

2. The change of census strategies between the last two census rounds

Table 1 classifies countries according to the type of census strategy adopted on the last two census rounds of 2001 and 2011. The groups are based on the categorization proposed by Eurostat[3]. A census is defined as 'traditional' when individual information is entirely collected within a narrowly defined time frame either through self-completed questionnaires or via enumerator-administered interviews[4]. The category 'register combined' includes all combinations of register-based censuses with sample surveys and conventional censuses or both.

Table 1: *Change in the classifucation of countries between 2001 and 2011 by census strategy*

Census 2001	***Census 2010***				***Total***
	Register based	***Register combined***	***Rolling census***	***Traditional***	
Register based	4	-		-	4
Register combined	2	4	-	-	6
Traditional	3	6	1	15	25
Total	9	10	1	15	35

During the last decade there is a clear trend of countries migrating from traditional to alternative approaches: whereas the number of counties which implemented

[2] The sample includes all EU countries with the exception of Germany where a population census did not take place in 2001, Canada, Israel, Switzerland, Turkey, The United States, Australia, Japan and New Zealand.
[3] Regulation (EC) No 763/2008 of the European Parliament and of the council of 9 July 2008 on population and housing censuses.
[4] Self-completed questionnaires can be mailed back by respondents, dropped at collection points or submitted online. Enumerators can interview people face-to-face or by phone. Questionnaires can be delivered in different formats (short and long) in sampled EAs.

conventional population censuses fell from 25 to 15 the number of countries which opted for an either register-based or register-combined strategy nearly doubled (from 10 to 19)[5]. The next section looks in more detail at the possible drivers of these shifts.

3. The drivers of change

There are many factors which could explain why some countries have decided to abandon traditional censuses in favor of other strategies. The transition may be directly linked to difficulties experienced during the previous census round but it can also be affected by enabling features such as the existence of population registers which could be exploited for census purposes. Demographic factors such as population size, ethnic diversity, urbanization, internal migration are also expected to be influental. Finally the macroeconomic enviromnment such as the size of public debt, the political climate like the government stability and credibility as well as technological factors like level and quality of access to the internet are also likely to be important. Table 2 presents summary statistics for a number of dimensions. Countries are allocated to two groups labelled as ‘traditional’ and ‘register based o combined’. Group A includes those countries which implementend traditional-type censuses in 2001 but will switch to either a register based or a a combined approach in 2011. Group B on the other hand comprises those countries whose censuses will remain traditional in the fortcoming census round.

Table 2: *Factors affecting the transition: Mean values by group type*

Dimension	***Indicator***	***Mean Group A***	***Mean Group B***
Duration and costing (last census)[a]	Number of days required for the data entry	8,1	7,2
	% of total budget spent for field operations	58,1	44,1
	% of total budget spent for data processing	9,3	18,2
	% of total budget spent for data analysis	2,3	1,7
	Per capita cost of census ($, at ppp prices)	9,7	6,7
Registers[a]	Existence of population registries	10	7
	Existence of an individual PIN number	4	2
Demographic factors	Population size (‘000)[b]	21.308	38.915
	% of population aged 20-40 [b]	29,1	27,8
	% of residents with foreign citizenship[c]	13,8	11,0
	% pop living in urban areas[d]	71,7	70,2
Other factors	Indicator of government credibility[e]	1,0	1,1
	% total public debt to GDP[f]	45,5	56,4
	Num of IP addresses per 1,000 inhabit.[g]	54,7	49,3
N		9	15

[a] United Nations Economic Commission For Europe, [b] U.S. Bureau – International Database, [c]OCSE – “foreign born”, [d] United Nations Population Division, [e] Worldwide Governance Indicator - Worldbank, [f] OECD – OECD.StatExtracts, [g] Internet Domain Survey

[5] Interestingly, France is the transition away from the conventional approach does not rely on the use administrative population registers.

Table 2 shows that those countries which have decided to start using registers in 2011 had experienced on average higher census costs in 2001 than those country that decided to stay traditional. For instance, group A's countries have a greater incidence of enumeration costs on their total census budgets (58,1% vs 44,1%). Also the per capita total cost of the 2001 census was significantly higher (9,7 vs a 6,7 US dollars). Group's B countries have on average a lower proportion of foreign residents and a higher public debt (as percentage of GDP) in 2001 compared to countries in group A (56,4% vs 45,5%). The number of active IP addresses per 1.000 inhabitants is on average higher for group A (54,7 vs 49,3). Although this evidence provides a partial account of the possible drivers of census strategy changes over time, nonetheless they seem to capture some of the dynamics behind the decision of a country to shift to more cost effective and less time consuming population censuses. We are aiming to extend the paper by adding more dimensions as well as more country-years to the analysis in order to be able to estimate a panel data model of the transition from traditional to other forms of census-taking.

4. Concluding remarks

During the last decade the traditional population census model based on an exhaustive enumeration of individuals living in a certain country at a given time has been questioned on a number of accounts: its ability to portray in a snapshot populations which are increasingly mobile, its financial feasibility as budgets constraints become tighter, its public acceptability as respondents become increasingly weary of statistical polls and surveys. In response to these pressures a number of countries, including Italy, have been taking important steps towards reforming the traditional model with effect from the census round of 2010-2011. The paper has focused on these transitions in order to understand their potential drivers. The preliminary results suggest that the main driving force is the urge to correct imbalances and inefficiencies from the last census round. However, besides these, there is a mix of demographic, economic, political and technological factors which additionally seem to contribute to create an enabling environment for transitions to occur.

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VRIStat: Measuring the Italian Statisticians' Research Activities

Maurizio Carpita

Abstract In this paper we present a model for the evaluation of the statisticians' research activities recently proposed by a Committee of the Italian Statistical Society and a user-friendly application (named VRIStat) allowing an easy computation of the indices of this model.

1. Introduction

In 2009 the Italian Statistical Society (SIS) appointed a Committee entrusted with the definition of criteria in order to evaluate statisticians' research activities. These criteria could be employed for example for the selection of which research projects should be granted by the government. The Committee was chaired by Giovanna Nicolini and composed by Maurizio Carpita, Marisa Civardi, Marica Manisera, Giancarlo Manzi, and Franco Peracchi. In May 2010, the Committee proposed a model and an index (VRI) for the evaluation of individual research activity to the SIS. Such model, defined after a long debate among the Committee members, also required a survey involving a sample of SIS members, asked to assign importance weights to the sub-dimensions used in defining the VRI index. The survey results along with the model and the VRI index were fully described in a final report (Nicolini et al., 2010) and presented at a Workshop on the Evaluation of research in Statistics (University of Bologna, March 2010). After this experience, the application VRIStat, allowing the use of the proposed model to evaluate statisticians' curricula, was developed.

The aim of this paper is to describe the proposed evaluation model and to show how the VRIStat application works. Some hypothetical curricula will be used in order to illustrate different situations.

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2. The evaluation model of the research activities

The criteria proposed by the Committee to rate a single statistician' research activity can be applied starting from his/her curriculum/certification. It leads to the definition of the VRI index, useful to rank scholars belonging to the same scientific field. Such index could be used by different institutions for different objectives. However, it was firstly proposed as a tool to allocate funds with the aim of rewarding who intensively contributes to research.

Generally, the activities of researchers are considered to be composed of different dimensions: (*a*) *ability in doing research*, which can be related to the number of scientific papers published in the evaluation period; (*b*) *research quality*, usually measured by bibliometric indicators (for example, Impact Factor or Science Citation Index), which however are affected by different drawbacks, or by the "peer review" method (not feasible in this context); (*c*) *activities related to research*, like organizing conferences or acting as a referee in the peer review process of articles submitted to journals for publication, that do not produce articles but contribute to the development of scientific knowledge (as pointed out in Tucci et al., 2010, with reference to Economics).

In the evaluation model proposed by the SIS Committee, dimensions (*a*) and (*b*) are grouped together in the AREA 1 – PUBLICATIONS. Dimension (*c*) composes the AREA 2 – ORGANIZATION and is divided into two sub-dimensions: the first one refers to the participation or organization of research groups and conferences (AO_P, Organizational Activity - Participation) and the second one refers to the editorial and retraining activity (AO_E, Organizational Activity - Editorial). Variables belonging to each area are reported in Table 1.

For each dimension and sub-dimension, an evaluating index can be defined and values can be graphically represented (Nicolini *et al.*, 2010).

For AREA 1 – PUBLICATIONS, the index is defined as

$$\mathrm{AP} = \frac{1}{\mathrm{T}} \cdot \sum_{i=1}^{9} \delta_i^P \cdot I_i^P \cdot \left(\sum_{j=1}^{n_i} C_{ij} \right)$$

where, with reference to the i-th activity of AREA 1, δ_i^P is the relative weight of its importance and I_i^P is the indicator of its presence (I_i^P=1) or absence (I_i^P=0), n_i is the number of publications of type i and C_{ij} indicates the contribute of the researcher to the j-th publication of type i;[2] T represents the period of time chosen as reference for the evaluation of the researcher.

[2] We use $C_{ij} = \exp[-k\cdot(a_{ij}-1)]$, where a_{ij} is the number of the authors of j-th publication of type i.

Table 1: *Variables of Publications and Organization areas*

AREA 1 – PUBLICATIONS (AP)
P1. Paper on A-class scientific journal
P2. Paper on B-class scientific journal
P3. Paper on C-class scientific journal
P4. A-class book collecting papers
P5. B-class book collecting papers
P6. A-class book
P7. B-class book
P8. Department working paper published on the department website
P9. Conference short paper (abstract 2-4 pages)
AREA 2 – ORGANIZATION (AO)
2.1 *Participation and/or organization of research groups and/or conferences*
O_P1. Chair of granted research group (PRIN, FSE, …)
O_P2. Member of granted research group (not chair)
O_P3. Chair of Scientific Program Committee of conference
O_P4. Member of Scientific Program Committee of conference (not chair)
O_P5. Speaker at conferences, seminars, workshops
2.2 *Editorial, retraining and visiting activities* (AO_E)
O_E1. Editor or co-editor of scientific journals
O_E2. Member of scientific journals editorial board
O_E3. Reviewer for scientific journals
O_E4. Volume editor
O_E5. Supervisor of PhD thesis
O_E6. Visiting at foreign institutions

AO_P measures the importance of the researcher's organizational activities related to participation:

$$AO_P = \frac{1}{T} \cdot \sum_{i=1}^{5} \delta_i^{O_P} \cdot I_i^{O_P}$$

where, with reference to the *i*-th activity of AREA 2.1, δ_i^{OP} is the relative weight of its importance and I_i^{OP} is the indicator of its presence (I_i^{OP} = 1) or absence (I_i^{OP} = 0).

On the other side, AO_P measures the importance of the researcher's editorial organizational activities:

$$AO_E = \frac{1}{T} \cdot \sum_{i=1}^{6} \delta_i^{O_E} \cdot I_i^{O_E}$$

where, with reference to the *i*-th activity of AREA 2.2, δ_i^{OE} the relative weight of its importance and I_i^{OE} the indicator of its presence (I_i^{OE} = 1) or absence (I_i^{OE} = 0).

For AREA 2 – ORGANIZATION globally considered, the index is defined as

$$AO = \gamma \cdot AO_P + (1-\gamma) \cdot AO_E$$

where γ is the relative weight of sub-dimension AO_P.

Finally, the global evaluation of the research activity of a single researcher is given by the following index of evaluation of individual research

$$VRI = \alpha \cdot AP + (1-\alpha) \cdot AO = \alpha \cdot AP + (1-\alpha) \cdot [\gamma \cdot AO_P + (1-\gamma) \cdot AO_E] =$$

$$= \alpha_1 \cdot AP + \alpha_2 \cdot AO_P + (1-\alpha_1-\alpha_2) \cdot AO_E$$

where α is the relative weight of the importance of AREA 1, $\alpha_1 = \alpha$, $\alpha_2 = (1-\alpha)\cdot\gamma$.

When VRI is used to compare researchers, some problems arise if the sub-indices composing VRI have different orders of magnitude. In order to remove these problems, a normalized version of the index is defined and called VRIC index:

$$VRIC = \alpha \cdot AP^* + (1-\alpha) \cdot AO^* = \beta_1 \cdot AP^* + \beta_2 \cdot AO_P^{**} + \beta_3 \cdot AO_E^{**}$$

with[3] $AP^* = AP/max_R(AP)$, $AO^* = AO^{**}/max_R(AO^{**})$,

$$AO^{**} = \gamma \cdot AO_P^{**} + (1-\gamma) \cdot AO_E^{**}$$

with $AO_P^{**} = AO_P/max_R(AO_P)$, $AO_E^{**} = AO_E/max_R(AO_E)$ and

$\beta_1 = \alpha$, $\beta_2 = (1-\alpha)\cdot\gamma/\lambda$, $\beta_3 = (1-\alpha)\cdot(1-\gamma)/\lambda$ e $\lambda = max_R(AO^{**})$.

The model weights α, γ, and k was obtained using a "*consensus approach*" (similar to the budget allocation process; Nardo et al., 2008) by a survey of 95 SIS members (see for details the appendix in Nicolini et al., 2010).

3. VRIStat to measure the research activities

Using Microsoft Access we developed an application useful to compute VRI and VRIC indices for one or more researchers[4]. The application is user-friendly and will hopefully guarantee the diffusion of the use of VRI and VRIC indices in order to continue the study of the evaluation topic, by involving all SIS members and other scholars. It is worthy to note that SIS has recently appointed a new Committee that should join the work on research evaluation along with the classification of statistical journals (for more information: www.sis-statistica.it and "*Valutazione della ricerca nelle scienze statistiche*" link).

Figure 1 shows how VRIStat appears when just opened. The three buttons allow to (1) add a researcher with his/her characteristics, the research time period and the curriculum; (2) modify and update the data of each researcher; (3) generate reports and compute the VRI and VRIC indices, export data in Excel format and set up the model weights (α, γ, C_{ij} and k)[5].

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[3] $max_R(\cdot)$ is the relative maximum of index $(\cdot)$ obtained by the best curriculum in the set of the considered curricula.

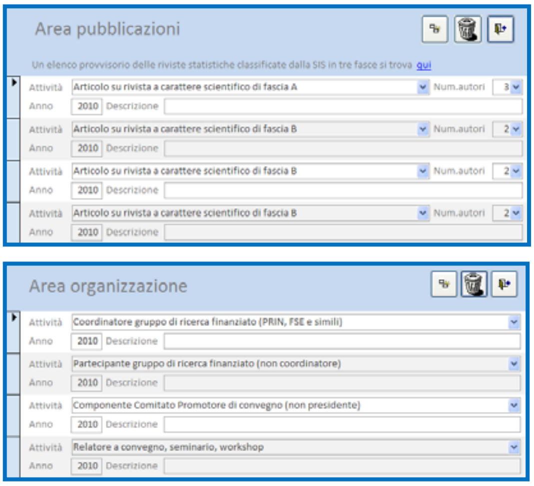
[4] We are grateful to Dr. Silvano Baronchelli for his support.

[5] The VRIStat default weights are those obtained from the SIS survey.

Figure 1: The start screenshot of VRIStat

With a click on the first button "*Inserisci un nuovo ricercatore*" a new researcher can be added with personal information (role, scientific sector, first research year), and a wizard allows to quickly insert his/her publications in the "*Area Pubblicazioni*"; the input of organizational activities follows the same pattern, after the access in the "*Area organizzazione*" (Figure 2)[6]. For each year of the research time period it is possible to reduce the months of the research activity (for example, to take into account career interruptions due to maternity). With a click on the second button "*Aggiorna un curriculum*" it is possible to modify and update characteristics, research time period, publications and activities of each researcher included in the database.

Figure 2: Inserting in VRIStat publications activities for a researcher



Finally, the third button "*Crea rapporti di valutazione della ricerca*" allows to view and print the full curriculum, the VRI and VRIC indices. "*Rapporti individuali* (*seleziona un ricercatore*)" tab allows to view the computation of sub-indices composing the VRI index (Figure 3), while the comparison of the VRIC indices of several researchers are obtained by clicking "*Rapporti collettivi*" (Figure 4).

[6] In a future version VRIStat will allow to import research data from external resources.

Figure 3: The VRI report from VRIStat for one researcher

Rapporto di valutazione della ricerca individuale
del Dott. Ricercatore A

Periodo della valutazione: dal 2005 al 2010

La tabella riporta le pubblicazioni e le attività organizzative valutate, l'indice VRI con le sue componenti

Pubblicazioni

Produzione articoli e volumi	Num.
Articolo su rivista a carattere scientifico di fascia A	1
Articolo su rivista a carattere scientifico di fascia B	3
Volume collettaneo di fascia A	2
Volume collettaneo di fascia B	1
Comunicazione a convegno (abstract 2-4 pagine)	4

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Organizzazione

Partecipazione o organizzazione di gruppi di ricerca o convegni	Num.
Coordinatore gruppo di ricerca finanziato (PRIN, FSE e simili)	1
Partecipante gruppo di ricerca finanziato (non coordinatore)	1
Componente Comitato Promotore di convegno (non presidente)	1
Relatore a convegno, seminario, workshop	1

Indice AOp 47

Attività editoriale e di aggiornamento	Num.
Revisore per rivista scientifica	1
Visiting presso altra istituzione straniera	1

Indice AOe 19

Indice AO 34

Indice VRI 70

Figure 4: The VRIC report from VRIStat for eight researchers

Rapporto degli indici di valutazione della ricerca individuale a fini comparativi (VRIC)

Periodo della valutazione: dal 2005 al 2010

La tabella riporta l'indice VRIC con le sue componenti per i ricercatori selezionati nel periodo considerato

Ricercatore	AOp**	AOe**	AO**	AO*	AP*	VRIC	VRIC %
Dott. Ricercatore A	16	6	11	11	29	23	26
Dott. Ricercatore B	68	57	63	63	100	89	100
Dott. Ricercatore C	28	41	34	34	91	73	83
Dott. Ricercatore D	49	29	40	40	60	54	61
Dott. Ricercatore E	15	43	27	27	78	63	71
Dott. Ricercatore F	0	12	6	6	62	44	50
Dott. Ricercatore G	100	27	67	67	47	53	60
Dott. Ricercatore H	100	100	100	100	29	51	58

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Relative poverty lines for Italian regions

Arianna Carra, Elena Longoni[1]

Abstract Usually, the relative poverty analysis in Italy is based upon a unique threshold established in order to the households' consumptions expenditure. Every year, the national consumptions expenditure *per capita* sets the poverty line for a two members household and then the *Carbonaro* scale is used to determine the equivalence expenditure of households of different size.
Nevertheless, several studies appear according to the criticism that in this way the differences in purchasing power and in consumption attitudes (that they may be present in the different geographic areas of the inland) are ignored. The aim of this paper is to build a specific relative threshold for any Italian region starting from the same expenditure data and to analyze the emergence of poverty related to these.

1 Introduction and targets

During the last decade, several studies have dealt with the issue of poverty measurement and the necessity to determine individual poverty lines for specific subgroups of population[2].

Usually, the poverty analysis use a unique threshold to identify and to quantify the units (individuals or households) that can be considered economic deprived in a particular society. But in these terms, in case of a wide and heterogeneous society, a country-wide threshold could be unsuitable to measure poverty in smaller areas than the entire country. Even if the poverty line represents the amount of resources necessary to get a certain living condition (the "minimum" acceptable, related to times and place in which people are living) in a given society, the differences in purchasing power and in consumption attitudes that may subsist in different geographic areas of the inland could bring to significant variations in the level of resources required[3]. For instance, several

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[2] See, for example, Bozzon et al. (2005), Civardi and Chiappero Martinetti (2008), Coccia, Colombini and Masi, (2002).

[3] "Moreover, local consumption habits, traditions and cultural conventions, as well as socio-economic and natural environment can contribute to determining remarkable inter-community

studies[4] have proved that in Italy, by using a unique "national" relative threshold, the number of units which may be considered poor is systematically overestimated in the South of country and undervalued in the North.

Furthermore, even if the consumption expenditures – and, consequently, the level of a relative poverty line – are widely conditioned by the standards of living present in a given society, it would be reasonable suppose that individuals and households tend to compare their own resources and living condition with the resources available from units living in the same area and not in the whole nation[5].

For the exposed reasons, we propose an evaluation of the headcount ratio of the relative lack units living in Italian regions by using specific regional thresholds.

1.1 Origin data, the Istat's Household Budget Survey and the national relative and absolute poverty lines.

The analysis of poverty proposed here is based upon the Istat's Household Budget Survey data collected in the year 2008. The sample survey regards about 24,000 households of the inland and the results are about current expenditure, such as food expenditure, electricity, telephone charges, furnishing and housing, clothing, transport and communication, and so on. Other items regard socio-economic and demographic households features, durable goods ownership, habits and preferences for shopping sites (supermarket, hard discount, traditional shop, etc.), and so on.

Moreover, Household Budget Survey data are useful to determine estimates for national accounting, consumer price indexes, absolute and relative poverty. Regarding this last point, relative poverty threshold for a two members household equals to the national consumptions expenditure *per capita*. Absolute poverty threshold, instead, is obtained evaluating minimum costs required to achieve a set of "basic needs", containing food, clothing, shelter needed and other goods and expenditures for facilities considered basic and fundamental. Absolute poverty threshold changes for household size and ages of components, geographical area (North, Centre or South of Italy) and by city size (metropolitan area, large and small cities).

Finally, *headcount ratio* is the proportion of households that show a consumption expenditure equal or less than the poverty line.

2 Relative poverty lines for Italian regions

For the above reasons, we propose a poverty line for each Italian region. We have estimated the headcount ratio for each region by using the consumption expenditures for each single area.

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differences in living conditions, thus justifying the adoption of group-specific poverty thresholds" (Civardi and Chiappero Martinetti (2008), p. 307).

[4] See, for example, Bozzon et al. (2005) and Coccia, Colombini e Masi, (2002).

[5] See also Accolla (2009), p. 57 and Civardi and Chiappero Martinetti (2008), pp. 305-306.

In practice, we have estimated the consumptions expenditure[6] *per capita* for each region and then we have equalized the poverty line for a two members household living in a specific region to the corresponding consumptions expenditure *per capita*[7]. To determine the equivalence expenditure of households of different size, we have used the *Carbonaro* scale of equivalence.

Table 1: Regional poverty lines (two members household) and *headcount ratios* estimated on the base of regional and national thresholds. 2008.

Landmark	***regional poverty line (euro)***	***headcount ratio (%) with regional poverty lines***	***headcount ratio (%) with national poverty line****
Piemonte	1.151,07	9,8	6,6
Valle D'Aosta	1.158,69	11,1	6,5
Lombardia	1.230,18	10,6	4,8
Trentino Alto Adige	1.103,40	8,8	5,2
Veneto	1.177,63	8,9	3,3
Friuli Venezia Giulia	1.133,88	11,9	6,6
Liguria	1.103,19	10,4	9,5
Emilia Romagna	1.228,56	11,0	6,2
Toscana	1.075,16	7,5	4,0
Umbria	1.073,98	8,1	7,3
Marche	986,42	5,3	6,3
Lazio	1.007,62	8,1	7,9
Abruzzo	891,17	10,5	13,3
Molise	756,82	12,8	13,6
Campania	675,39	7,3	21,3
Puglia	761,04	7,8	20,2
Basilicata	711,57	11,4	26,3
Calabria	701,00	8,4	22,9
Sicilia	672,27	8,3	27,6
Sardegna	814,65	9,2	22,9

Source: Household Budget Survey
* Source: Istat (2009).

3 Results and future developments

As shown in Table 1, the regional consumption expenditures *per capita* – and in turn the regional specific poverty lines – are quite different depending on landmark. For

[6] For each household, the amount of consumption expenditure leaves out extraordinary repairs costs, life insurance and annuity costs, mortgage payments, loan repayments (see also Istat (2009), p. 11).
[7] To determine the regional consumption expenditure *per capita*, we have used the mean residents living in family.

Istat[8], in 2008 the consumption expenditures *per capita* was 999,67 euro: estimating *headcount ratios* for each region using this value, it would seem that relative poverty is widespread in the South and more controlled in the North of Italy. Instead, using regional specific thresholds, it would appear that living in the North is more expensive than living in the South of the Country. The analysis of poverty shows regional *headcount ratios* more balanced all over the inland. Indeed, the regional consumption expenditures *per capita* in the North of Italy and in some region of the Centre are higher than in the South regions. Moreover, the income differences existing at region level should be taken into account. According to several studies[9], it appears that incomes in the North and Centre of Italy are higher than those of households living in the South, but we should also take into account differences that may exist in terms of purchasing power and in consumption attitudes. As already mentioned, Istat in recent years has developed a new approach to estimate absolute poverty, accepting the fact that prices for the purchase of those goods and services can be very different in the inland and recognizing that some needs can be felt and satisfied differently depending on where you live. The absolute poverty lines processed for 2008[10] shows that, considering the same family composition and city size, the thresholds for households living in the North Italy are always higher than those calculated for families in Centre and Southern Italy. It should be noted that in each of the three large regional clusters, the cost of the set of basic needs is decreasing if we shift from a metropolitan area to a large town and from the latter to a small town.

In accordance with the above comments on absolute poverty lines, it would seem more correct to estimate relative poverty by adding specific thresholds for metropolitan areas, large and small cities.

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[8] Istat (2009), p. 1.
[9] See, for example, Istat (2010).
[10] Istat (2009), p. 10.

Women in Italy. A Long-Term Perspective

Maria Casalini, Anna Scattigno

Qual è il retroterra storico nel quale affonda le radici la condizione attuale delle donne in Italia? È questa la domanda alla base del nostro intervento che, in una brevissima carrellata attraverso una dimensione di lungo periodo, prendendo le mosse dagli ultimi decenni dell'Ottocento per arrivare fino agli anni Ottanta del Novecento, si propone di mettere in evidenza i tratti caratteristici della condizione femminile e soprattutto dei movimenti che nel corso del tempo si sono fatti promotori di un progetto di emancipazione (più o meno reale) per le donne.

Quando si parla dell'esperienza del femminismo, del momento cioè in cui le donne hanno fatto la loro comparsa sulla scena pubblica per rivendicare la propria "liberazione" si pensa subito agli anni Settanta. L'immagine delle italiane in piazza è immediatamente collegata alla «stagione dei movimenti». Ma in realtà è agli ultimi decenni dell'Ottocento che risalgono le origini del pensiero femminista: nel 1880 erano nate infatti le prime *Leghe per la difesa degli interessi femminili*, incentrate sulla rivendicazioni dei diritti delle lavoratrici e il diritto di voto. Poi, all'inizio del secolo, avevano preso corpo altre iniziative: si erano costituite l'Associazione per la donna, L'Unione femminile nazionale, il Comitato nazionale pro suffragio e il Consiglio nazionale delle donne italiane, che avrebbero affiancato alla battaglia per i diritti civili un'intensa attività assistenziale. Se negli anni Settanta del '900 il principio ispiratore del neofemminismo era stata la rivendicazione della «differenza» femminile, quasi un secolo prima le battaglie per la conquista dei diritti che l'introduzione del Codice Pisanelli aveva negato alle donne all'indomani dell'Unità, erano state combattute dalle prime femministe in nome dell'affermazione del loro ruolo sociale come madri. Da allora il maternalismo sarebbe rimasto l'elemento dominante nella tradizione del femminismo italiano. [1]

D'altra parte, anche la concezione cattolica sia pure con diversa finalità sottolineava la differenza tra uomini e donne, in particolare nei diritti e nei doveri all'interno della coppia coniugale. Come ebbe a sottolineare Leone XIII nella *Arcanum Divinae Sapientiae* (1880), il matrimonio nella dottrina cattolica è un istituto sociale di origine divina, sul quale la Chiesa affermava una competenza esclusiva. Nella famiglia, fondata su un sacramento e un contratto non separabili l'uno dall'altro, le relazioni della coppia erano ispirate a un principio di subordinazione della donna all'uomo, «principe della famiglia e capo della moglie». La dignità della donna, sposa e madre, derivava non dall'affermazione di diritti individuali di cittadinanza, ma dalla conformità a compiti e doveri ordinati nella coppia secondo la legge naturale: in lui che governa e in lei che obbedisce, sottolineava Leone XIII, è la carità divina che modera i doveri. Questo forte ancoraggio dell'istituto del matrimonio e della famiglia al diritto naturale era destinato a condizionare a lungo in Italia la condizione giuridica e sociale delle donne, rafforzando lo stereotipo della "vocazione" materna e familiare come carattere perenne del femminile, così come la soggezione, che nella concezione cattolica non è schiavitù, precisava Leone XIII, perché nel matrimonio cristiano la donna rende obbedienza all'uomo come compagna, non come ancella. Senza disconoscere la fondamentale missione familiare della donna, tra Otto e Novecento la Chiesa andava ormai precisando i lineamenti di una militanza femminile che appariva ormai auspicabile e necessaria, per ricondurre nell'alveo del suo insegnamento una società e una cultura dominate dal positivismo e dall'indifferenza religiosa, e per contrastare il femminismo, che parlava di diritti e di libertà e che almeno inizialmente pareva intrecciare il suo percorso con le rivendicazioni del socialismo.

Inizialmente si era stabilita infatti una certa fluidità, tra la militanza nelle organizzazioni femministe e socialiste e tra i due movimenti sembrava profilarsi la prospettiva di un camino in comune. Nello *Statuto del Partito Socialista dei Lavoratori italian*i si riconosceva, non a caso, l'uguaglianza giuridica e politica delle donne e si faceva propria la parola d'ordine «a uguale lavoro uguale salario». Saldamente inseriti nel solco della tradizione secondinternazionalista che con la pubblicazione de *La donna e il Socialismo* di August Bebel aveva dato avvio alla nascita di una corrente emancipazionista, i socialisti italiani si sarebbero in seguito adeguati alla linea

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[1] Cfr. A. Buttafuoco, *Questioni di cittadinanza: donne e diritti sociali nell'Italia liberale*, Siena, Protagon, 1997.

imboccata al Congresso di Zurigo nel 1893, secondo cui le priorità della lotta politica si incentravano sulla richiesta di un legislazione di tutela del lavoro delle donne e dei fanciulli. Ed è su questo terreno che si otterranno gli unici risultati concreti (la legge Carcano del 1903), mentre i rapporti tra femminismo e socialismo andranno progressivamente deteriorandosi, fino alla definitiva rottura segnata dalla dichiarazione dell'incompatibilità dell'adesione alle due organizzazioni, nel 1911.

La Chiesa d'altra parte aveva già respinto ogni possibilità di incontro con il femminismo: la stessa espressione «femminismo cristiano», con cui alcune cattoliche nei primi anni del Novecento avevano tentato di individuare una propria militanza distinta dai gruppi femministi di ispirazione laica e socialista, subirà una brusca delegittimazione ed avrà breve corso. Dopo la rottura con questi ultimi, consumatasi a Roma nel 1908 durante il primo congresso nazionale delle donne italiane, nasce così l'Unione fra le donne cattoliche d'Italia, voluta da Pio X, su posizioni decisamente più conservatrici di quelle che avevano caratterizzato nei primi anni del secolo il Fascio democratico cristiano femminile e la rivista «Pensiero e Azione», fondati entrambi da Adelaide Coari, una delle più significative esponenti del femminismo cristiano. Dall'Unione sarebbe nata nel 1918, per iniziativa di Armida Barelli, la Gioventù femminile di Azione cattolica. Un moderato accesso delle donne all'istruzione era ormai anche per Pio X un portato dei tempi che non era più possibile contrastare, ma era del tutto contrario al voto politico. Quanto al lavoro extra-domestico, nella cultura cattolica che considerava l'esclusiva destinazione familiare della donna una preziosa e insostituibile risorsa per l'unità della famiglia e l'ordine sociale, questo era visto al più come una dolorosa necessità dalle inevitabili ricadute negative nell'educazione dei figli e nella coesione della coppia.

Ma anche sul fronte socialista, la figura della donna lavoratrice appare tutt'altro che valorizzata in quelli stessi anni. Nel corso di un' «età giolittiana» che vedeva la crescita e il consolidarsi delle strutture del movimento operaio, la presenza delle donne (che insieme ai fanciulli rappresentavano nel 1901 più del 40% della manodopera impiegata nell'industria) subiva infatti una contrazione sostanziale sia all'interno delle organizzazioni sindacali, sia per quanto riguarda la partecipazione agli scioperi. Per farsene un'idea basti pensare che le 18.000 iscrizioni del 1902 alla Federazione delle Arti tessili – nel settore cioè dove si concentrava la maggior parte della manodopera femminile – due anni dopo di erano già ridotte a 8.000, mentre la partecipazione agli scioperi calava dal 40% alla fine dell'800 al 23,4% del 1903.

Ma che cosa si nasconde dietro questa apparente "involuzione" della tradizione socialista in tema di eguaglianza tra i sessi? In realtà la questione è complessa: molte restano le ambiguità sul piano teorico e tutt'altro che scontata l'interpretazione dei fatti. Il presupposto da cui partire del resto, quando si parla di relazioni di genere, è che spesso le prese di posizione ufficiali corrispondono all'esatto rovesciamento della realtà. Ed è da questo assunto di fondo che ha preso le mosse l'interpretazione di Brigitte Studer, tesa a dimostrare come sin dalle origini la strategia del movimento operaio si rivelasse saldamente *male centered.*[1]

Lo stesso Hobsbawm, per parte sua, aveva osservato che la contraddizione più profonda del movimento operaio risiedeva proprio nella professione di un'ideologia di emancipazione sessuale, destinata poi a tradursi nella pratica nello scoraggiamento della partecipazione paritaria di uomini e donne alle organizzazioni e alle lotte del lavoro.[2]

Se l'ideologia socialista si presenta dunque – ed è ancor oggi considerata - come quella che ha dato il maggiore contributo, tra il XIX e il XX secolo, alla battaglia per l'eguaglianza dei sessi, di fatto, la storia del movimento operaio va in tutt'altra direzione. Fonte primaria della contraddizione il principio secondo cui l'eliminazione delle discriminazioni di genere, prospettata come il risultato automatico della rivoluzione socialista, appare altrettanto irrealizzabile, per definizione, in un contesto di tipo capitalistico. Qui, concentrandosi sul tema del lavoro, quello della donna finisce inevitabilmente col risolversi in un "doppio sfruttamento" da parte del capitale, che assumendo manodopera femminile si assicura la disponibilità di forza-lavoro a prezzi inferiori, con la conseguenza di deprimere i salari maschili e di generare la disgregazione della famiglia proletaria. Non è dunque difficile scorgere al di sotto delle rivendicazioni della eguaglianza salariale che caratterizza i primi decenni della strategia socialista un obiettivo essenzialmente espulsivo della concorrenza della manodopera femminile sul mercato del lavoro, da parte degli organizzatori sindacali: fine ultimo il "salario familiare", che avrebbe consentito al capofamiglia di mantenere moglie e figli. I primi ad organizzarsi, d'altra parte, ci ricorda Studer, sono gli operai qualificati, e per loro l'obiettivo di incarnare il modello del *male breadwinner* – centrale, per tutto il XX secolo nell'ideologia socialista non meno che in quella cattolica– appare più a portata di mano. Il quadro è destinato a cambiare quando la massa dei lavoratori dequalificati comincia ad apparire maggioritaria, e il supporto del salario femminile risulta indispensabile al sostentamento della famiglia; allora si profila la nuova strategia di tipo «protettivo» del lavoro della donna, destinata a sfociare in una legislazione tanto largamente aggirata nella pratica quanto funzionale, sul piano simbolico, nel differenziare il contributo

[1] B. Studer, *Genre et Class dans le movement ouvrier*, in J. Batou, M. Cerutti, . Heimberg, *Pour une histoire des gens sans histoire*, Lousanne, Editions d'En Bas, 1995, pp. 121-36.; cfr. anche L. Frader, S. O. Rose, *Gender and Class in Modern Europe*, Ithaca and London, Cornell University Press, 1996, pp. 193-210 .

[2] E. Hobsbawm, *Uomo e donna:immagini a sinistra*, in *Lavoro cultura e mentalità nella società industriale*, Bari Laterza 1986, pp. 112-13.

economico femminile, etichettato comunque come occasionale e accessorio, rispetto a quello dell'uomo.
Considerata come un'eterna minorenne, osservava al tempo Anna Maria Mozzoni, l'operaia d'altra parte non aveva accesso a nessun tipo di specializzazione.[1]
In sostanza, se a livello internazionale si levano alcune voci in difesa del valore emancipatorio del lavoro, nel sottofondo appare evidente la condivisione della costruzione di genere tipica del modello borghese di famiglia, secondo la quale la donna sposata è essenzialmente destinata alla cura del marito e dei figli. E non poche energie vengono investite in una campagna di "educazione alla maternità" destinata alle donne del popolo, mentre a imperare sono le teorie positiviste. Così l'immagine di donna che tende a delinearsi a partire da fine '800, nella propaganda socialista, è quella di una figura debole e remissiva, «intristita da secoli di ignoranza», e «intisichita» dal lavoro: preda dei sentimenti, il suo orizzonte mentale non travalica i confini dello spazio domestico. Per questo, si afferma, è insensibile al richiamo della solidarietà. La scarsa partecipazione alle lotte sindacali lo dimostra, si ribadisce, senza tener conto del fatto che, come ha osservato Franco Della Peruta, le organizzazioni sindacali stesse, saldamente in mani maschili, sono tutte orientate alla difesa degli interessi dei lavoratori qualificati e non tengono in alcuna considerazione le rivendicazioni femminili.[2]
E' così che le donne, indiscusse protagoniste delle «lotte di popolo» di Ancien Régime, come ha sottolineato Edward Thompson[3] vengono sostanzialmente espulse dall'orizzonte della storia della «lotta di classe», mentre nelle campagne, dove è concentrata la maggior parte delle lavoratrici (e dei lavoratori), continua ad imperare il patriarcato.
Anche sul piano politico le rivendicazioni del suffragio femminile appaiono più formali che reali, mentre ad affermarsi dopo il 1912 sarà il fermo rifiuto di ogni forma di compromesso con la «democrazia borghese», al cui interno si tende a catalogare qualsiasi componente di tipo "femminista".
Sul contributo delle donne, in chiave prettamente antimilitarista, si punta in occasione della guerra di Libia, e poi soprattutto della guerra mondiale, che le avrebbe viste giocare un ruolo di primo piano nelle manifestazioni pacifiste. Ma un conflitto di genere è destinato a riaccendersi - più violento che mai – nel contesto bellico, e non tenderà a attenuarsi nel dopoguerra, di fronte all'emergenza del reinserimento dei reduci nel mondo del lavoro.

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[1] Cfr. adesso A. M. Murari, *L'idea più avanzata del secolo. Anna Maria Mozzoni e il femminismo italiano*, Roma, Aracne 2008.
[2] F. della Peruta, *La fisionomia della classe operaia*, in M. Antonioli, M. Bergamaschi, L. Ganapini (a cura di), *Milano operaia dall'800 a oggi*, Cariplo- Laterza, Milano-Bari, 1993, p. 6.
[3] E.P. Thompson, *Società patrizia cultura plebea*, Torino, Einaudi 1981, ' p.98 e id., *Customs in Common*, London, The Merlin Press, 1991, p. 305.

Proprio gli anni della prima guerra mondiale rappresentano del resto un momento di particolare tensione fra i sessi. La nostalgia degli affetti familiari non immunizza i soldati da un risentimento sordo nei confronti di donne che, immaginate dalle trincee, appaiono troppo disponibili a prendere il posto dei richiamati, contribuendo con il loro lavoro per l'industria bellica alla prosecuzione della guerra. Mentre la stampa liberale e cattolica esalta l'abnegazione delle italiane, quella socialista, per parte sua, si impegna a rafforzare i risentimenti maschili. La guerra rappresenta, non a caso, il momento di maggior valorizzazione del lavoro femminile. Non certo perché, come si sarebbe affermato al tempo, le donne per la prima volta avevano lasciato la casa per la fabbrica. Né perché, come ha osservato Barbara Curli, esse avessero effettivamente «sostituito» gli uomini sul posto di lavoro.[1] Quanto perché avevano avuto accesso per la prima volta a settori produttivi – come quello della meccanica – fino a quel momento di competenza esclusivamente maschile, e il loro ruolo appariva per questo straordinariamente "visibile".

Le guerre del resto – ha affermato Thébaud – rappresentano sempre un momento di «rafforzamento» del femminile.[2] Tanto più la prima guerra mondiale che per i militari, ha ricordato Leed, si era trasformata in una vera e propria esperienza di «femminilizzazione», di passività e di estenuanti attese.[3]

Non solo il contributo delle donne appare per la prima volta essenziale nel campo del lavoro, ma significativo si rivela anche il ruolo delle organizzazioni femministe, che dalla posizione di iniziale pacifismo, erano passate ad un sostegno attivo ai combattenti, impegnandosi in tutta una serie di opere assistenziali.

L'apporto femminile allo sforzo bellico viene dunque sancito dall'abolizione dell'autorizzazione maritale, nel 1919: l'unica riforma significativa sul piano del diritto, in età liberale, in tema di rapporti fra i sessi. Ad avviarsi in realtà sarà anche una discussione sulla richiesta del voto amministrativo, che sarebbe stato poi Mussolini a concedere nel 1925 – peccato però che di lì a pochi mesi avrebbe abolito le elezioni.

Anche adesso, nelle rivendicazioni di diritti da parte delle donne a dominare è la chiave maternalista, mentre sempre molto deboli sono destinate a restare in Italia le istanze neomalthusiane, che tutt'altro rilievo avevano invece assunto all'estero: in Francia, ad esempio, ma anche in Belgio. L'unico testo destinato ad una vasta circolazione è il volumetto di Luigi Berta e Secondo Giorni, *L'arte di non fare figli*, uscito nel 1912 e distribuito in più di 27.000 copie.

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[1] B. Curli, *Italiane al lavoro (1914-1920)*, Venezia, Marsilio, 1998,

[2] F. Thébaud, *La Grande guerra: età della donna o trionfo della differenza sessuale?*, in G. Duby, M. Perrot (a cura di), *Storia delle donne in Occidente. Il Novecento*, Roma-Bari, Laterza 1992, pp. 25-90.

[3] E. J. Leed, *Terra di nessuno. Esperienza bellica e identità personale nella prima guerra mondiale*, Bologna, Il Mulino, 2007.

Se d'altra parte la guerra avrebbe suscitato ovunque preoccupazioni sul piano demografico, il pronatalismo sarà uno dei cavalli di battaglia del fascismo. Mogli e madri esemplari, le donne italiche – secondo i progetti mussoliniani – avrebbero dovuto pensare essenzialmente a far figli.
D'altra parte Pio XI nella *Casti Connubii* (1930), destinata a rimanere una pietra miliare del pensiero cattolico, ribadiva che «qualsiasi uso del matrimonio, in cui per la umana malizia l'atto sia destituito della sua naturale virtù procreatrice, va contro la legge di Dio e della natura». Nell'enciclica le pratiche di limitazione delle nascite, e l'aborto, che rientravano in quello che chiamava «uso perverso del matrimonio», erano legati proprio all'emancipazione della donna, che espressamente si definiva una richiesta di eguaglianza nei diritti che vorrebbe scalzare «la fedele e onesta sottomissione della moglie al marito»: «emancipazione» nella direzione della società domestica, nell'amministrazione del patrimonio, «e nell'esclusione e soppressione della prole». Secondo i sostenitori di questa dottrina, esercitando la propria «libera volontà» - ma piuttosto «nefanda scelleratezza», affermava il pontefice - la donna si sarebbe sottratta ai suoi pesi di madre, alla cura domestica e alla famiglia, per dedicarsi così «agli affari e agli uffici, anche pubblici». Il giudizio di Pio XI al riguardo era durissimo: si trattava di una falsa libertà, della corruzione dell'indole femminile e della dignità materna, di una «innaturale uguaglianza con l'uomo», contraria al bene della famiglia e alla «doverosa unità e fermezza dell'ordine e della società domestica».
Nella realtà, d'altro canto, i reiterati appelli sia del regime che dei vertici vaticani alla maternità non sembrano trovare un riscontro positivo. Né i tassi di natalità subiscono improvvise impennate, né il numero delle lavoratrici registra una drastica contrazione. Anzi si avrà un forte aumento delle presenze femminili nel terziario e in fondo solo simbolica finirà col rivelarsi la valenza della legislazione espulsiva dal pubblico impiego del 1938: entrata in vigore nel '40 sarà infatti abolita dopo pochi mesi, a causa dell'ingresso in guerra. Fortemente conservatore – se non addirittura misogino – il fascismo avrebbe finito peraltro con l'avere ricadute contraddittorie sul piano delle relazioni di genere. Mai come durante il regime si è registrata una differenza di classe tanto forte tra le donne, ha osservato Vittoria De Grazia[1]. Ma soprattutto, come ha sottolineato Dittrich-Johansen, proprio negli anni Trenta, paradossalmente, per le italiane si sarebbe profilata per la prima volta una via d'accesso alla sfera pubblica.[2] Il progetto di un'organizzazione tendenzialmente totalitaria della società italiana non poteva certo escludere le masse femminili, ed è così che alle piccoloborghesi si prospetta anche la possibilità di intraprendere vere e proprie "carriere" politiche.

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[1] V. De Grazia, *Le donne nel regime fascista*, Venezia, Marsilio 1993, p. 32.
[2] H. Dittrich-Johansen, *Le militi dell'idea. Storia delle organizzazioni femminili nel Partito nazionale fascista*, Firenze, Olschki, 2002,

La definitiva conquista della «cittadinanza» sarà comunque ancora una volta il «premio» che le italiane riceveranno solo nel corso della seconda guerra mondiale. Una guerra che si sarebbe rivelata molto diversa dalla prima, sul piano dei rapporti di genere. Se nel 1915-18 si era verificata una netta separazione tra combattenti e fronte interno, in un conflitto di trincea destinato a innescare il risentimento dei militari nei confronti degli "imboscati" e della masse femminili in generale, durante la seconda guerra mondiale, che vede il dissolvimento del fronte e annovera immense perdite tra i civili, a imperare è uno spirito solidaristico tra uomini e donne, uniti nello sforzo comune di sopravvivere e di gettare le basi per un futuro migliore.

Sarà quindi un clima di rinnovata collaborazione fra i sessi a caratterizzare la stagione del secondo dopoguerra, che vede d'altra parte le grandi innovazioni sul piano politico fare aggio, come osserva De Luna, su una sostanziale continuità sul versante del costume.[1] La nuova Italia repubblicana, che vedeva il prestigio della Chiesa - uscita miracolosamente indenne dal crollo del fascismo – raggiungere il suo massimo storico, finisce in tal modo con il collocare al centro delle propria identità sociale l'istituzione familiare, nella sua versione più tradizionale e gerarchica. Ed è così che, nella realtà come nella propaganda politica, si assiste al ripristino dei ruoli "naturali" dei sessi. Anche la Resistenza, che in un primo momento aveva alimentato nelle partigiane che avevano dato vita ai Gruppi di Difesa della donna la speranza di una futura valorizzazione del ruolo femminile sia nel lavoro che nella gestione della cosa pubblica, si risolve, nella memoria collettiva, in una esperienza di *maternage* di massa.[2] Non a caso, la prima riforma significativa del dopoguerra riguarderà ancora una volta la «tutela della maternità», estendendo, in sostanza, anche alle contadine le norme protettive della legge del 1936.

Sta di fatto che mai si sarebbero registrati in Italia indici di occupazione femminile tanto bassi come nel dopoguerra (nel 1951 il 10,3% del totale dei lavoratori; nel 1931 erano il 12,3%). A testimonianza della costruzione di una figura materna come perno dell'istituto familiare, gli anni Cinquanta rappresentano la *Golden Age* della casalinga, anche se, soprattutto a partire da fine decennio il Miracolo economico avrebbe generato la comparsa di ampie - quanto incommensurabili – sacche di lavoro nero.

Solo apparente risulta così il paradosso dell'assenza di una politica di *welfare* per quella stessa famiglia che è chiamata dalla Democrazia cristiana a giocare un ruolo tanto importante nella Prima repubblica. In realtà il rifiuto della sicurezza sociale, quale minaccia nei confronti della famiglia intesa come «comunità naturale», basata su una figura femminile subordinata ai dettami

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[1] G. De Luna, Partiti e società negli anni della ricostruzione, in F. Barbadoro (a cura di), *Storia dell'Italia repubblicana*, vol. I, *La costruzione della democrazia*, Torino, Einaudi, 1994, pp. 754-57.

[2] A. Bravo, A.M. Bruzzone, *In guerra senz'armi. Storie di donne 1940-1945*, Roma-Bari, Laterza, 1995.

della religione e dedita ad una totalizzante missione di cura appare il nocciolo del “connubio” tra De Gasperi e Pio XII. Alla pari del Partito socialista, nemmeno il Pci sarebbe stato del resto in grado di proporre un modello alternativo di famiglia, per rimandare alle rappresentazioni della società sovietica la realizzazione del progetto di “coppia paritaria”, della quale affermava, formalmente, di farsi portatore.

Nello stesso momento in cui le donne affollano le urne e fanno per la prima volta il loro accesso in Parlamento, una forte continuità caratterizza quindi, com’era prevedibile, il contesto del dopoguerra sul piano legislativo, laddove il codice Rocco godrà ancora di lunga vita.

La prima riforma che arreca un vulnus di una qualche entità a quel concetto di «mascolinità egemonica» che connota lo scenario politico e sociale dell’Italia repubblicana sarà la legge Merlin. Dopo dieci anni di lotta solitaria della senatrice socialista, finalmente nel 1958 si sarebbe cancellata anche in Italia – fanalino di coda dell’Europa – la «prostituzione di Stato». Proprio durante la discussione del progetto di legge alle Camere, d’altro canto, avrà modo di esplicitarsi la sopravvivenza di preconcetti di matrice prettamente positivista nei confronti della figura femminile. Gli stessi preconcetti avrebbero fatto sì che solo nel 1963 cadesse il divieto per le donne di accedere alla magistratura.

È solo durante gli anni Sessanta infatti che si assisterà all’apertura delle prime falle nell’intelaiatura normativa di uno stato postfascista che un po’ grossolanamente, ma senza timore di smentita, potremmo definire “maschilista”. Una struttura che la coraggiosa battaglia delle costituenti era riuscita solo in parte ad indebolire, come appare evidente dal testo dell’articolo 37 della Carta approvata nel 1948, nel quale da un lato si ribadisce l’eguaglianza dei sessi nel campo del lavoro ma dall’altro si precisa che, per la donna, qualsiasi attività extradomestica deve conciliarsi con «l’adempimento dell’essenziale funzione familiare». Sempre nel 1963 sarà inoltre sancito il divieto di licenziamento per matrimonio e nel 1964 si avrà l’abrogazione del coefficiente Serpieri, secondo cui il «valore» del lavoro agricolo della donna equivaleva al 60% di quello dell’uomo. Dovremo tuttavia arrivare al 1968 per la revisione della legislazione sull’adulterio, che contemplava sanzioni fortemente differenziate sulla base del sesso, mentre solo gli anni Settanta vedranno realizzarsi le riforme più significative sul piano del costume: nel 1970 il divorzio, nel 1971 l’abolizione dell’articolo 553, che vietava la propaganda di mezzi anticoncezionali; nel 1975 la riforma del diritto di famiglia, con la ratifica dell’uguaglianza dei coniugi; nel 1977 la parità retributiva e infine, solo nel 1981 la cancellazione del cosiddetto «delitto d’onore».

Questo, in estrema sintesi, il panorama istituzionale. Diversi appaiono però gli umori e le spinte che vengono dalla cosiddetta «società civile», laddove le trasformazioni della famiglia e dei costumi che erano percepibili già prima della stagione delle riforme, negli anni Cinquanta e Sessanta, avevano posto in parte le premesse per la rivoluzione che avverrà alla fine degli anni Sessanta con il movimento femminista. A stimolarne l'origine, in Italia come altrove, sarà un duro scontro generazionale. Insofferenti nei confronti dei ruoli femminili tradizionali rappresentati dalle madri, le giovani degli anni Settanta rifiutano la soggezione e non nutrono più alcuna deferenza verso l'autorità, neppure quella della Chiesa che così tenacemente aveva segnato in Italia la vita delle donne. Come sottolinea Bruna Bocchini, l'enciclica di Paolo VI *Humanae Vitae* (1968), con il suo intransigente diniego di una sessualità disgiunta dalla procreazione, aveva aperto un divario con le donne, destinato a incidere profondamente sul processo di laicizzazione della società.[1] Lo scontro di generazione è destinato così a diventare anche scontro politico: se nei decenni precedenti le lotte delle donne in Italia avevano avuto come obiettivo l'eguaglianza giuridica, la parità salariale, la tutela, le giovani parlano ora di libertà, di sessualità, di corpo.

Su questa base, tra il 1970 e il 1973, in molte città e in centri minori nascono gruppi e "collettivi", con riferimenti culturali e ideologici differenti. Tra le donne che danno avvio al movimento, alcune hanno già esperienze politiche, nei partiti, nei sindacati, nell'Unione Donne Italiane (Udi); altre, la maggior parte, provengono dal movimento studentesco, dall'esperienza del Sessantotto e dalla Nuova Sinistra. Più che un'origine unica, il movimento ha avuto tanti inizi; a Padova nel 1970 con Lotta femminista, all'Università di Trento con Il cerchio spezzato, a Milano con Anabasi, e poco dopo, nel 1972, con lo spazio di Via Cherubini, che diverrà uno dei luoghi più significativi del femminismo italiano. Poi ancora Torino, Bologna, Roma, Napoli, e tante altre città minori fino alla Sicilia: tasselli di una mappatura che è ancora in larga parte da ricostruire. Il primo gruppo a praticare il separatismo e l'esperienza dell'autocoscienza era stato probabilmente Rivolta, fondato da Carla Lonzi, a cui appartiene uno dei primi documenti del femminismo italiano, *Il Manifesto di Rivolta*. Negli scritti del gruppo, si operava una decostruzione radicale della cultura maschile e si affermava una differenza femminile che si opponeva a ogni possibile omologazione, rifiutando l'eguaglianza come progetto politico.

Come ha sottolineato Anna Rossi-Doria, il femminismo in Italia non è stato così solo un fenomeno sociale e culturale, ha avuto invece una forte valenza politica, assumendo una posizione di distanza ed estraneità nei confronti delle riforme e delle istituzioni.[2] Contrario all'idea di eguaglianza e al concetto di «parità» che aveva rappresentato la bandiera delle donne della generazione precedente - soprattutto quelle organizzate nell'Udi, ma anche del sindacato e

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[1] B. Bocchini Camaiani, *Famiglia e sessualità nel Magistero dal Concilio Vaticano II a Giovanni Paolo II*, in E. Asquer, M. Casalini, A. Di Biagio, P. Ginsborg, *Famiglie del Novecento. Conflitti, culture e relazioni*, Roma, Carocci, 2010, pp. 198-204.

[2] A. Rossi-Doria, *Ipotesi per una storia che verrà*, in T. Bertilotti, A. Scattigno (a cura di), *Il femminismo degli anni Settanta*, Roma, Viella, 2005, p.18.

dei partiti – il femminismo italiano ha sostenuto con forza il tema della «liberazione» e la portata dirompente della libertà femminile.
Tra il 1974 e il 1979 il movimento avrebbe raggiunto la dimensione di un fenomeno di massa, segnando la nascita di un nuovo soggetto destinato ad affermarsi anche sulla scena politica. La doppia militanza, nelle organizzazioni di provenienza e nel femminismo, è un aspetto poco indagato, che segnerà agli inizi e in modo conflittuale il percorso di molte femministe, per risolversi poi in una separazione particolarmente difficile nel caso di Lotta Continua e non priva di scontri. Un altro aspetto finora poco indagato ma che rappresenta una cifra peculiare del movimento in Italia è stato il femminismo sindacale: l'intercategoriale delle delegate Cisl-Gcil-Uil era nato a Torino nel 1975, mentre il Coordinamento nazionale delle delegate e lavoratrici Flm si era organizzato nel 1977: è stata certo un'esperienza breve, ma di grande interesse per la riflessione condotta dalle sindacaliste sui rapporti tra donne e lavoro, con elaborazioni destinate, allora, a non trovare riscontro e che oggi sono oggetto di un rinnovato interesse, nella crisi che colpisce in particolare l'occupazione e il lavoro femminile.
La crisi del movimento è destinata comunque a consumarsi tra il 1977 e il 1979. Le femministe si erano occupate ben poco del nuovo diritto di famiglia, della legge sui consultori, delle stesse leggi di parità, anche se proprio la legislazione riformista era stata fortemente sollecitata dalla presenza del movimento sulla scena politica. Allora, la discussione attorno alla legge sull'interruzione volontaria di gravidanza avrebbe rivelato di fatto un conflitto profondo tra quante sostenevano la semplice depenalizzazione e la difesa del principio di autodeterminazione, e quante invece sostenevano la necessità di mediazioni politiche, anche se non esprimevano quella politica nuova che il movimento femminista aveva prefigurato. Il 1977 segnava d'altra parte nella storia italiana la chiusura di un'intera fase storica e l'emergenza di nuove culture giovanili; d'altra parte il clima di violenza crescente nel paese, culminato nella morte di Aldo Moro, segnerà anche per il movimento femminista una cesura.
Ancora tutti da studiare restano i decenni successivi: riguardo agli anni Ottanta, ad esempio, possiamo parlare di un «femminismo diffuso» o piuttosto ci troviamo di fronte ad una fase di "riflusso" in una dimensione privata e individualistica? Probabilmente i due fenomeni si intrecciano fra loro. Sugli ultimi decenni del resto disponiamo solo di analisi sociologiche. Ciò che emerge dalle indagini più recenti, come ha rilevato Letizia Mencarini, è d'altro canto un'inequivocabile condizione di "difetto" delle italiane: rispetto alle donne del resto d'Europa fanno meno figli, lavorano meno e ricevono meno aiuti nei lavori domestici dai coniugi. E certo le lacune di un sistema di *welfare* «occupazionale», tutto incentrato – ha osservato Naldini - sulle «solidarietà familiari e parentali» giocano una parte rilevante nel contesto di questo

fenomeno che è giustamente stato definito di «emancipazione incompiuta».[1] Quanto un tale comportamento sia imputabile anche a fattori culturali, all'"ipermaternalismo" delle italiane che, pur riducendone il numero, non rinunciano ad un ruolo singolarmente "protettivo" nei confronti dei figli e ad un perfezionismo e protagonismo domestico sconosciuto alle nordeuropee è difficile da dirsi. Fatto sta che le donne che hanno mantenuto un ruolo occupazionale l'unica alternativa è stata quella del «doppio lavoro», dentro e fuori casa: un doppio lavoro che negli ultimi decenni, ha ragione Chiara Valentini, si è fatto "triplo", dal momento che anche l'assistenza ad un numero sempre crescente di anziani grava completamente sulle loro spalle.[2] Come ha recentemente osservato Perry Willson insomma, il panorama italiano di fine '900, sul versante femminile, resta pieno di contraddizioni: «un affascinante intreccio di modernità e di tradizione», così lo definisce la storica inglese.[3]

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[1] M. Naldini, *Le politiche sociali in Europa: trasformazione dei bisogni e risposte di policy*, Roma, Carocci, 2006, pp. 57-62.
[2] C. Valentini, *Le donne fanno paura*, Milano, Il Saggiatore, 1997, p. 80.
[3] P. Willson, *Italiane. Biografia del Novecento*, Roma, Laterza, 2011, p. 341.

Integration of administrative data to estimate structural business statistics (SBS) variables in the sample survey on Italian small and medium enterprises

Maria Cristina Casciano[a], Viviana De Giorgi[b], Filippo Oropallo[c],Giampiero Siesto[d]

Abstract
In last years the availability of large administrative data sources together with the purpose of reducing statistical burdens has encouraged the launch of various projects in restructuring the production of official business statistics. The issue of missing response and the difficulty to handle with bias-effects in sample surveys as well has brought to exploit the possibilities offered by external sources as a benchmark and a way of statistical estimation. By using fiscal agency sources, together with financial statements, an experimental estimate of main Structural Business Statistics (such as turnover, value of production, intermediate costs, value added, labour costs and gross operating surplus) has been done for the year 2007. The study may be summarized in these steps: first, the analysis of the population coverage, using classification variables, such as the typology of economic activity, the size, the legal type; second, the comparisons of the meaning and the contents of the variables from fiscal questionnaires with the respective SBS variables and the reconstruction of summarized variables, via respondent unit; third, the imputation of the main variables, through the fiscal ones, also to the subset of non respondent units and the re-weighting of the final sample, thus obtaining a new (secondary) estimate for 2007; fourth, the comparison between the primary (from sample weight calibration only) versus secondary estimates in order to quantify the estimation discrepancy, by distinguishing the "source effect" and the "non response effect" and to measure the reduction of the sampling error; fifth, the use of the results obtained in the experimental analysis for the estimates of the year 2008.

Keywords: structural business statistics, administrative sources, micro-integration, non-response, calibration estimators, sample bias

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1. The Small-Medium Enterprises Survey and the sampling strategy

The experimental analysis used the data from the Small and Medium-sized Enterprises (SME) sample survey, carried out annually by Istat with the purpose of investigating mainly profit-and-loss account of enterprises with less than 100 persons employed. Sampling design of the SME survey is a one stage stratified random sampling without replacement and with equal probabilities, with the strata defined by the combination of the modality of the Nace economic activities, size classes of persons employed and administrative regions. The number of units selected was about 105,000 enterprises: about 37,000 questionnaires were filled in, and for improving the low response rate, in the 20-99 size classes of persons employed data were integrated by using financial statements (about 6,300 units) and then the estimates were calculated on the basis of about 43.700 units, by applying the methodology based on calibration estimators (Deville and Sarndal, 1992). The estimator of the total *Y(D)* referred to the domain *D* is:

$$\widetilde{Y}_{(D)} = \sum_{k \in s_r} w_k \, y_k \, I_k(D) \quad (1)$$

where s_r is the set of respondent units (respondent and imputed); k is the unit index, w_k is the final weight, y_k is the observed (or imputed) value of the variables of interest; $I_k(D)$ equals 1 if the unit k belongs to domain D, and 0 otherwise

The final weight w_k is obtained as a product of three factors:

$$w_k = d_k \gamma_{1,k} \gamma_{2,k} \quad (2)$$

where:

- d_k is the direct weight (the reciprocal of the inclusion probability);
- $\gamma_{1,k}$ is the Total Missing Response (TMR) correcting factor ;
- $\gamma_{2,k}$ is the "post-stratification" factor.

After calculating the TMR correcting factors as the ratio of the number of sampled units and the number of respondent units belonging to appropriate "weighting adjustment cells", the weight of every single enterprise is further modified in order to match known or alternatively estimated population totals. In particular, known totals of selected auxiliary variables of Business Register (BR) (number of enterprises and number of persons employed in the year *t*) are currently used to correct for sample-survey non-response or for coverage error resulting from frame under-coverage or unit duplication (Casciano et al. 2006).

2. The experimental matching between SME survey sample units and the available administrative sources units

The administrative sources used in the experimental analysis are the Financial statements and the Tax Authority sources (Tax returns forms and the Fiscal Authority survey) that are linked with the identifying code of the BR. The SME reference population of the BR is about 4.5 million of enterprises which employ approximately 12.9 million persons. Besides tax returns and financial statements data, Istat acquires directly from the Tax Authority the Sector Studies survey (Fiscal Authority Survey): it is a fiscal survey aiming to evaluate the capacity of enterprises to produce income and to know whether they pay taxes correctly. It includes about 4 million enterprises with a turnover greater than 30 thousand euros and less than 7.5 million euros: almost all enterprises are obliged to fill in the Sector Studies survey form together with the tax return and to declare in detail costs and income items. Since we have different types of sources to be used for recovering information about non-respondents units of the initial sample, we have to determine priorities in using only one of them to impute each unit. Based on the universe coverage, the number of available comparable variables, and the coherence to the SME survey variables by using an indicator based on the Kolmogorov-Smirnoff statistic, we decide to use first the financial statement source, then the Sector Studies survey, and last the tax return data.

After the analysis of coherence among subsidiary sources, we can outline the coverage of the SME survey sample in terms of number of units and information contents. Financial statements and Sector Studies together with Tax return, cover almost all sampled enterprises (about 95%, except for coverage list errors): what remains are only the largest partnerships with an ordinary accountancy regime and very small sole proprietorships. Although we have a very high coverage level, some problems about the total number of variables to be used and the definitions harmonization among sources occur. The main variables common to all sources (Financial Statement, Sector Studies survey, Tax Return data) are: income from sales and Services (turnover), changes in stock, changes in contract work in progress, other income and earnings, purchases of goods and services, use of third party assets, other operating charges, personnel costs. Moreover there are two further variables, value added and gross operating value that can be calculated with the previous ones. The administrative variables content comparability has been assessed by comparing both their definitions and their values in frequency distribution with survey variables.

3. Results of integration of SME survey with administrative data and re-estimation

Administrative sources permit to cover almost all sample units of the SME survey, so it has been possible to extend the reconstruction of SBS variables for both respondent units (47% -> S1) and non respondent ones. The initial estimates (1), based on the subset of respondents (S1) is:

$$\widetilde{Y}_{\alpha} = \sum_{S1} y_k \ w_k \quad (3)$$

Final estimates on the integrated sample (S2: survey plus administrative data, that represent about 90% of initial sample), with a new set of final weights w^* is:

$$\widetilde{Y}^*_{\alpha} = \sum_{S2} y^*_k \ w^*_k \quad (4)$$

Final mixed estimate on the integrated sample (S2) is:

$$\widetilde{Y}^{**}_{\alpha} = \sum_{S1} y_k \ w^*_k + \sum_{S2-S1} y^*_k \ w^*_k \quad (5)$$

that can be written as:

$$\widetilde{Y}^{**}_{\alpha} = \sum_{S2} y^*_k \ w^*_k + \sum_{S1} y_k \ w^*_k - \sum_{S1} y^*_k \ w^*_k = \widetilde{Y}^*_{\alpha} - \sum_{S1} (y^*_k - y_k) w^*_k \quad (6)$$

The difference between the final estimate $\widetilde{Y}_{\alpha}^{**}$, based on the integrated sample (survey plus administrative data) and the initial estimate $\widetilde{Y}_{\alpha}$ of the same variables is equal to the sum of three components:

$$\widetilde{Y}_{\alpha}^{**} - \widetilde{Y}_{\alpha} = \sum\nolimits_{S1} (y_k^* - y_k) w_k - \sum\nolimits_{S1} (y_k^* - y_k) w_k^* + \sum\nolimits_{S2} y_k^* (w_k^* - w_k) \quad (7)$$

The three components are the following:

1. The substitution effect for respondent units set evaluated with old weights w_k: $\sum_{S1} (y_k^* - y_k) w_k$ (8)
2. The substitution effect for S1 evaluated with new weights w_k^*: $\sum_{S1} (y_k^* - y_k) w_k^*$ (9)
3. The non response effect for the reconstructed units of the theoretical sample: $\sum_{S2} y_k^* (w_k^* - w_k)$ (10)

The differences between estimations have been evaluated for the Turnover, Total costs and Value Added. In general the analysis shows that the total difference is more affected by TMR than the substitution of data sources. The mechanism besides the TMR is not random and the use of Financial statements and Fiscal survey data for integrating all the TMR of the theoretical SME sample reduces the possible biases caused by the non-respondents self-selection. The experimental study reveals that, for turnover, administrative data produce coherent estimates to survey ones at a high level of aggregation. The discrepancy obtained by using the variable integrated with administrative information instead of the current SME survey variable is 0.03% for Turnover, and -4.5% for Value added, though it is higher when we drill down for economic activities and size classes. Finally, a simulation study has permitted to evaluate a gain in the efficiency of the estimator by reducing the error of 2 percentage points.

Now, the use of administrative data (Financial Statements and Fiscal Survey), has been adopted for the current SME survey, since the reference year 2008. The respondent units (36,584 units) and the integration of non-responses was made by using 22,511 units from the Financial statement sources and 24,549 units from Sector Studies. The sample used in the calibration procedure to determine the final weights has been of 81,726 units, which represents 77.9% of the theoretical sample.

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The attainment of longevity in Italy: the successes of a process lasting 150 years

Graziella Caselli, Viviana Egidi, Marco Marsili[1]

Abstract In the last 150 years the history of Italy has been interwoven with the various phases of the health transition that has brought a country that previously had one of the lowest survival rates in the world to among the highest in the classification. This paper tries to interpret the life expectancy trend in the light of the mortality dynamic by age and cause of death, with the aim of a better and more reliable definition of the possible future path of Italian longevity.

1 An ongoing process…

The Unification of Italy saw the start of a process that was to transform, profoundly and irreversibly, the meaning of life, both individually and collectively: at the time of Unification the Italian life expectancy was one of the lowest in Europe, with average values around 30 years (Natale and Bernassola, 1973), when Northern Europe had already surpassed 40 years and Central Europe was fast approaching this threshold (Caselli, 1991, Caselli and Egidi, 1991). Ten years later, the situation was essentially unchanged (see Figure 1), although the declining mortality rates in the first year of life already anticipated a new phase that would make the "age of plague and hunger" (Omran, 1971) a thing of the past. It was only from the 1880s onwards that mortality rates began to reduce significantly in the other ages of life too, beginning the *health transition* a century later than England, and more than fifty years after France. Twenty years after Unification, in 1881, men and women could expect to live for around 34 years, and in the early XX century men had reached 42 years – a net gain of around 8 years. For women the dynamic was still more favourable (+9 years) under the effect of the notable contraction of risks of death linked to maternity. This positive development continued to accelerate in the following years, interrupted only by some events that affected Italy and much of Europe in the first half of the XX century: the outbreak of World War I, the Spanish Flu epidemic of 1918, World War II, and, more marginally, the mortality crisis created by the severe winters of 1900 and 1929 (see Figure 1).

Despite the major crises determined by two world wars, from the start of the decline in mortality to the mid XX century the average life expectancy had already doubled for men and more than doubled for women (63 years and 67 years, respectively). Since then, the process has continued, accelerating towards the end of the 1970s. In 2007 Italian women (84.0 years of life expectancy) overtook Swedish and Danish women and are now second in Europe after the French, and third in the world, Japanese women occupying first place. For men too survival levels are among the highest in the world (78.7 years) and very close to those in Sweden and Japan, the latter of which heads the world classification for men too.

One particular aspect of this extraordinary dynamic is caused by the gradual gap

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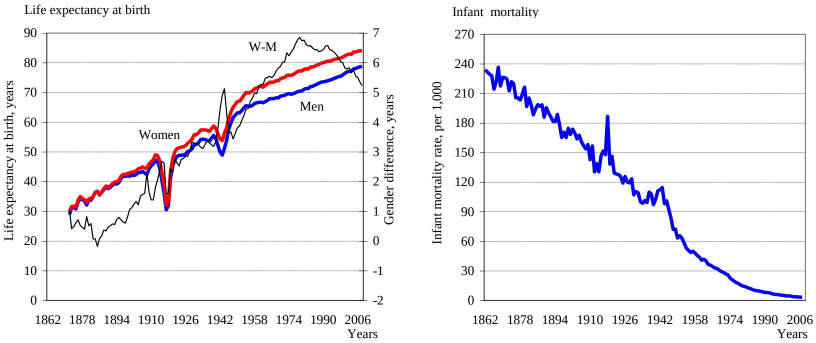
between men and women that can be seen throughout the XX century. The survival difference reached its peak in 1979 (6.9 years) before diminishing in the following years (5.3 years at present, see Figure 1).

The aim of this paper is to interpret the life expectancy trend in the light of the mortality dynamic by age and cause of death, trying to find reliable elements to better define the possible future path of Italian longevity.

Figure 1: **A**) Evolution of the life expectancy and of the gender difference from 1872 to 2008. **B**) Infant mortality trend from 1862 to2007. Italy.



Source: Human Mortality Database and Istat (A); Caselli, 1991 (B).

2 Data and methods

The data used are the mortality tables since 1872 and the rates of infant mortality from 1862 to 2007 (Natale and Bernassola, Caselli, Human Mortality Database, Istat). The mortality data for the main causes of death have been reconstructed from 1895 to 2007 (Caselli, Istat). The data available by cause do not allow us to include the early years of the health transition period. Our choice of causes of death was very much conditioned by the need for comparability over time, given the length of the period studied; this is the reason which forced the adoption of only selected chapters of the classification of diseases. Nevertheless those groups of causes allow us to follow the groups of diseases which played the most important role in the mortality dynamics (infectious respiratory diseases, i.e. bronchitis, pneumonia and influenza). Applying Pollard's decomposition method, we estimated the gains in survival obtained from Unification down to the present, thanks to the role played by the decline of mortality in different periods of life and by the causes of death considered.

3 Diseases and age in the survival dynamic

At the start of the health transition, the nosological profile of mortality was characterized by the dominant role played by infectious diseases (including respiratory ones), which accounted for more than half of the risk of death. After a century of progress, at the middle of the XXth century, the profile has radically changed, and infectious diseases have been replaced by chronic-degenerative diseases and tumours. This change has come about following the strong differentiation of the rhythms of reduced mortality for the different causes, those of acute, infectious diseases being stronger, and those of chronic, degenerative diseases being weaker and slower. For a long period the evolution of cancer mortality was even negative.

For the total gain of 39 years for men and 44 years for women during the period 1895-2007, around 9 were due to the reduction of the risk of dying from infectious diseases of the respiratory system, and around 8 from diseases of the digestive system. They are followed, in order of importance, by the other infectious diseases (just under 5 years for both genders) and diseases of the circulatory system (2.2 years for men and 3.6 for women). The dynamic of causes of death has had different phases in the course of time, in response to the modification of the socio-economic and health context, as can be seen from the contributions each cause has brought to the increase in average life span (Table 1). In the first period down to World War I the most important role was played by the reduction in diseases of the digestive system, infections of the respiratory system and other infectious diseases (overall, from 1895 to 1912 they added more than 6 years, both for men and women). These same diseases also played a preponderant role in the dynamic between the two wars (overall, almost 5 years of life gained), while tumours and diseases of the circulatory system remained essentially stable until World War II, with a slightly negative contribution to the increase in survival.

Only in the period after the war did the dynamics change radically and gradually trace the profile that by the end of the 1960s was to become the new mortality profile of contemporary Italy. In the period from 1946 to 1980, of the 12.8 years gained overall by men, 6.5 years continued to be obtained thanks to the reduction in infectious diseases and those of the respiratory and digestive systems, while increased cancers mortality risks were responsible for a reduction of one full year of life expectancy.

Table 1- Contribution by causes of death and by age groups and gender to variations in life expectancy at birth (years) in Italy during the past five periods.

Causes of death / Age group	1895 1912	1921 1940	1946 1980	1980 2007	1895 2007	1895 1912	1921 1940	1946 1980	1980 2007	1895 2007
			Men					**Women**		
Infectious diseases	1.7	0.9	0.9	-0.1	4.7	1.8	0.8	0.9	-0.1	4.8
Bronchitis, pneumonia, infl.	1.7	0.7	3.0	0.5	9.2	1.4	0.7	3.3	0.4	8.8
Neoplasms	-0.2	-0.2	-1.0	0.8	-1.2	-0.1	-0.1	-0.1	0.3	-0.4
Cardiovascular diseases	-0.2	-0.1	0.5	3.5	2.2	-0.1	0.0	2.3	3.7	3.6
Digestive diseases	2.7	2.5	2.6	-0.3	7.6	2.9	2.7	2.8	-0.2	8.2
Violent deaths	-0.2	0.4	0.4	0.8	0.4	0.0	0.1	-0.1	0.4	0.2
Other Causes	2.0	3.0	6.4	2.9	16.0	2.8	3.6	6.7	2.3	18.3
All causes	**7.6**	**7.2**	**12.8**	**8.2**	**39.0**	**8.6**	**7.8**	**16.0**	**6.8**	**43.6**
0	3.1	1.4	4.9	1.0	12.6	2.6	1.5	4.8	0.9	11.4
1-4	3.0	2.4	2.6	0.1	10.0	3.0	2.5	2.8	0.1	10.4
5-14	0.3	0.7	0.8	0.2	2.7	1.0	0.9	0.8	0.1	3.3
15-44	0.4	2.8	3.1	0.7	6.0	1.3	2.3	3.0	0.4	7.8
45-64	0.5	0.2	0.8	2.5	3.5	0.5	0.5	1.7	1.2	4.1
65-79	0.2	-0.2	0.5	2.7	3.0	0.2	0.2	2.3	2.4	4.3
80+	0.1	-0.1	0.2	1.0	1.2	0.1	0.0	0.7	1.8	2.2
All ages	**7.6**	**7.2**	**12.8**	**8.2**	**39.0**	**8.6**	**7.8**	**16.0**	**6.8**	**43.6**

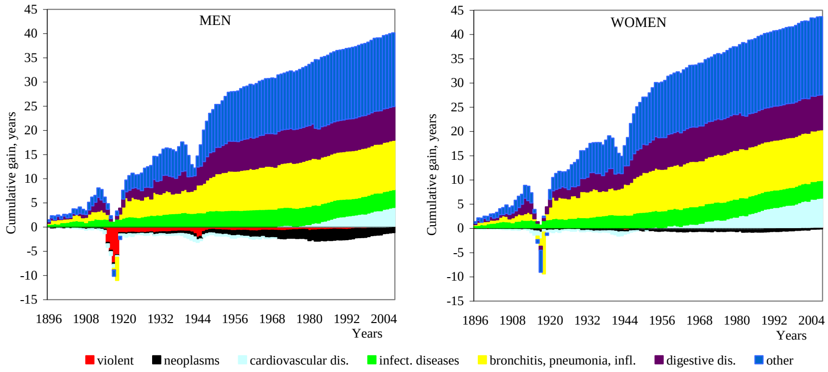
For women the total gain was greater (16 years), the same causes contributing 7 years, but, for the first time, 2.3 years being added thanks to a reduction in diseases of the circulatory system. It was these diseases that played the most favourable role in the final period (1980-2007), their reduction alone determining an increase of 3.5 and 3.7

years, for men and women respectively, in the face of an overall increase of 8.2 and 6.8 years.

The stages of the social and economic history of Italy and the achievements of medicine in this period are reflected in the changes in the risks of death from the various diseases and the successive phases of the health transition. The improvement in hygienic conditions and the raising of the level of life for Italians certainly played the most important role, but some improvements in the process towards ever-longer survival can be explained only thanks to the adoption of new medicine (for example, the introduction of antibiotics at the end of World War II) (Egidi, 2006). In recent years, when old people became the central figures for any further lengthening of survival, their life histories are completely different from those of the past: old people today are less fragile than previously, having lived physically less taxing lives, with better health controls, and when wellbeing has been able to produce positive long-term effects.

What can we expect in the future? If nothing compromises the positive development experienced so far, expectations can still be favourable. More and more effective social control over dangerous life styles, greater attention towards health, but also a growing investment in public health and prevention, may reduce the significant inequalities that still affect the Italian population and guarantee further increases in life expectancy and the achievement of that "longevity for all" that might become the aim of the health services in this millennium.

Figure 2:- Cumulative gains (in years) in life expectancy at birth resulting from the reduction of mortality by causes of death. Italy, from 1895 to 2007.



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The 15th Population Census Pilot Survey: how the register driven census changes the enumerators role

Lorenzo Cassata, M. Tiziana Tamburrano[1]

Abstract The strategy for next Population Census consists in new methods, that imply various techniques, depending on the territory, and the use of population registers to reach the census units.
The Pilot Survey (held the 25th of October 2009), had the goal to improve the methods and techniques for next census and it was articulated in 6 strategies.
Analysing the managing and monitoring system data (SGR), the evaluation of the enumerator's role in the various municipalities is possible. The enumerator's function, that will be weakened in next census, still will be central, as the Pilot Survey data analysis shows out. He was present in the all phases of the Survey. The confronting of the two main strategies makes possible an analysis of all the operations carried by the enumerator.

Key Words: Population Census, Pilot Survey, Methodology of Survey

1 Introduction

The main innovations for next census are: the mail out for questionnaires, the availability of several ways of collecting data (web, municipality collecting points, other collecting points, enumerators), and the continuous managing and monitoring of all delivery and collecting operations, by a specific information system (SGR).

The Pilot Survey was articulated in 6 strategies, depending on the municipality demographic size, the type of questionnaire, the system of delivery, and the method for unanswered questionnaires and under cover retrieving.

From the population register (*Lista Anagrafica Comunale*: LAC), 82,735 families were extracted, to deliver the questionnaires via mail, in the 31 municipalities included

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in the sample. In some municipalities the under cover retrieving of population register was tested. Information from “Poste Italiane” national archive (*GeoPost*) were included in the list that drove the operation. When a housing unit address was found in *GeoPost* archive and not in the LAC, the row had a status of “potential under cover” in the SGR system.

The first group of municipalities (more than 20,000 inhabitants) had a reduced strategy, as the LAC under cover retrieving was not included. The second and third groups were more complete, as they included the under cover retrieving and they were different only because of the time between the unanswered questionnaires retrieving and the first reminder by the enumerator.

The 4th and 6th groups were identical: both used enumerators for the unanswered questionnaires and under cover retrieving. The 5^{th} group, that characterized only 2 municipalities with less than 5,000 inhabitants, was a traditional one, as the enumerator was responsible for the delivering and retrieving of all questionnaires.

All the strategies gave to the respondents the choice to respond in different ways (*web*, municipality collection points, mail back, enumerator) and in the municipalities with more than 5,000 inhabitants (the groups between the first and the fourth) there were two types of questionnaires (a short and a long form). The objective of this paper is to evaluate how the innovations for next Italian Population Census will impact on the enumerator’s role, analysing the data collected during the Pilot Survey of 2009.

2 The enumerator’s role in the different Pilot Survey strategies

The enumerator, during the whole survey, updated the specific system (SGR) with the information, day by day. Analysing the data on the SGR system an evaluation of the enumerator’s role in the 31 municipalities in the survey is possible. The enumerator’s function, that will be reduced in next census compared to the past, still will be of primary importance, as the analysis of the Pilot Survey results shows.

The population register of the sampled 31 municipalities counted 82,735 families. 77,012 questionnaires (93.1%) were mailed to the LAC addresses. The remaining part was divided in 4,610 cases (5.6%) where the enumerators directly delivered the form to the families, because of some problems in the standardization of addresses, and 1,113 cases (1.3%), where the enumerators delivered the questionnaires, as the 5^{th} strategy (for the small municipalities Nimis and Cantalupo nel Sannio) set.

The enumerator participated to all phases of the survey: the direct delivery, the unanswered questionnaires and the under cover retrieving. This last was completely done by him. In the whole of the 31 municipalities the effective work on the field was: delivery (9.6% of LAC families), checks after unanswered questionnaires[1] (26.5%), reminders of unanswered questionnaires[2] (18.4%).

Obviously the interventions were of different number, depending on the strategy. 35,598 cases (43%) were found, in which the enumerator did not intervened, while in the fourth group they were more than 50%, and much less in group 2, 3 and 6. The

[1] “Checks” are defined as all the cases where the enumerator’s work was made necessary, because the family was not present, or was not possible to find, or the family refused to fill the form.
[2] “Reminders” are defined as al the cases where the enumerator contacted at least once the family.

questionnaires were "spontaneously" retrieved in 32,298 cases (39%). The last ones (3,300) remained unanswered at the end of the Pilot Survey.

Table 1. LAC Questionnaires by type of enumerator's intervention

Type of intervention	***Questionnaire***
Delivery	7,922
Check	21,942
Reminder	15,224
Retrieving	23,117
Revision	389
Total	*68,594*

Some differences are explained by the strategy itself. As for the LAC questionnaires, the phase that requires the most of the work for the enumerator, is, in the 3 first groups, the "checks" one, while for groups 4 and 6 is the "retrieving". Finally, in the 5th group the questionnaires delivery was done by the enumerators, and this was, non surprisingly, the dominant phase.

During the under cover phase, the "checks" phase is still of great importance for groups 2 and 3 (where the most of enumerator's work was to verify the "signals" by *GeoPost*), while in the 5th and 6th groups there was a complete intervention of enumerator (as predictable, because the enumerator, in these strategies, went through the all census section). In the 4th group it is confirmed the prominent role of enumerators in questionnaires retrieving.

Analyzing the interventions as a whole, all off the passages on the field for the unanswered questionnaires, and the under cover retrieving, the strategies that required a greater number of interventions were the 5th and the 3rd.

The average number of interventions for the 31 municipalities was about 119 every 100 questionnaires from LAC: 99 for the unanswered questionnaires retrieving, and 20 for the under cover retrieving. Having the objective of evaluating the enumerator's work during the Pilot Survey in the six groups, the interventions were also analyzed in reference to the territory. We considered the address, comprehensive of the building number, as analysis unit. In this way, counting the number of addresses where the enumerators directly intervened was possible, by municipality and strategy group. The percentage of addresses where the enumerator went at least once during the survey is 77.2. This value is about 90% in all bigger municipalities: Napoli (92.4), Messina (89.1), Roma (93.1), Genova (92.2), Palermo (97.2).

No relation exists between the strategy and the percentage of addresses visited by the enumerator, as it doesn't exist a higher percentage of interventions in the municipalities where the fieldwork was exhaustive, in respect of the ones where the retrieving was "focused": in fact the opposite happens. This result is not surprising, as the systematic retrieving was only set in the fourth group, in which all the municipalities were of smaller demographic size.

3 Confronting the two main strategies

Confronting the two main strategies (groups 3 and 4) makes possible to analyze what the enumerator did, during the under cover retrieving. The first group (municipalities over 20,000 inhabitants) was characterised by the mail out and the “focused” retrieving of under cover, while the second group (municipalities of minor size) had the complete retrieving of under cover by the enumerators. The retrieving percentages of the two groups are 10.6 (group 4) and 3.1 (group 3). The percentages become 8.7 and 2.1 if we exclude the not occupied houses. For each retrieved questionnaire, the enumerator did on average 5 interventions (5,831 interventions on 1,176 retrieved questionnaires), while in the fourth group the interventions were less than 3 for each questionnaire (1,025 on 357).

It is finally reasonable to conclude that, even if the required enumerators work on the field is greater (but it is not for each questionnaire), the strategy that implies the under cover complete retrieving on the municipality’s territory (group 4) got a better result as for the quantity of new units found, compared to the group 3, where the enumerators used the *Geopost* signals (almost half of those under cover signals were indeed not correct).

This result, that is affected by the extreme heterogeneity between the municipalities, could be greatly minor, if a significantly more efficient auxiliary list will be made available. That is what is supposed to happen with next Census, by the specific survey on the building numbers (RNC) and the signals that will come from administrative lists. Finally, the great behaviour’s variability among the municipalities during the Pilot Survey generally shadowed the differences between the chosen strategies. The strategy has also an effect on the retrieving result, that would be considered in next Census, in October 2011.

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Creating a longitudinal multi-source database: new challenges and opportunities

Cinzia Castagnaro, Antonella Guarneri, Sabrina Prati, Francesca Rinesi[1]

Abstract Data integration methods allow for a better exploitation of existing data. Starting from the last decades of the 20th century valuable efforts have been made to use those techniques in demographic field. Our paper develops along this path and seeks to illustrate the theoretical framework lying behind the possible creation of a multi-source database for the study of the interrelationship between marital formation (and dissolution) and reproductive behaviour. Our starting point is the Sample Survey on Births that Istat carried out in 2003 by interviewing a consistent sample of women who recently have had a child. Hence we identify the possible administrative sources that can be linked to the Sample Survey on Birth for recovering the demographic events of interest experienced by interviewed women in the subsequent years.

Keywords: longitudinal data; record linkage; multi-source database; reproductive behaviour.

1 General framework

In the recent decades an increasing demand for statistical information has been observed. At the same time the improvement in computer technology and the development of new methodological tools opened up new opportunities. Within this context, special attention is given to data integration methods that allow a better exploitation of existing sources (Falorsi, Pallara, Russo, 2005).

Record linkage techniques are widely used in several countries both for updating existing surveys and for creating new (more informative) one. Particularly relevant

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examples of the application of these techniques to demographic data are provided by the Scottish Longitudinal Study (Hattersley et al., 2007; Boyle et al., 2009) and by the ONS Longitudinal Study (Blackwell et al., 2003) whose aim are to reconstruct in a longitudinal fashion the life-course of a sample of resident population drawn by the Census. More precisely, those longitudinal data sources have been realized by linking the socio-demographic information collected by the Census with the vital events (births, deaths, marriages, …) and health variables derived from administrative sources registered in the next years that refer to the sample population. The starting point of the ONS Longitudinal Study is the 1971 Census: the socio-demographic variables are updated three times by using the information of the 1981, 1991 and 2001 Census. The start of the Scottish Longitudinal Study is the 1991 Census, updated with the socio-demographic variables of the 2001 Census.

The aim of this paper is to define the theoretical structure of a longitudinal database that exploit all the available information referred to marital formation and dissolution, reproductive behaviour, maternal and perinatal health but stored in different sources. Record linkage procedure would make possible to shed light to the complex relationship between all these aspects.

2 Theoretical structure

Differently from the studies previously mentioned, we do not drawn our attentions on Census data but rather on the collective of mothers interviewed during the first edition of the Sample Survey on Births, carried out by the Italian National Institute of Statistics in 2002. The sample size equals to nearly 50,000 women who have had a child approximately 18-21 months before (10% of the total live-births registered in 2000-2001). This survey retrieves in depth information concerning both the mother's (and her partner) socio-demographic conditions and the delivery as well as context variables.

We have then selected all the relevant administrative surveys enabling to recover the main information on the next years' reproductive behaviour, maternal and perinatal health of the mothers that make up our sample. Since the strong relationship between marital formation (and dissolution) and reproductive behaviour, we have selected also the sources that retrieve information on marriages, separation and divorces. By linking all these data base with the Sample Survey on Birth it is possible to create a longitudinal data that make possible to study in a prospective way the cohorts behaviour from 2002 to 2008.

In order to take into account of the possible loss and re-entries in our target population we planned to use the following sources (Figure 1):

- Register of causes of death;
- Changes of residence.

The reproductive behaviour of mothers interviewed in 2002 within the next years can be derived from:

- Survey on live-births;
- Survey on induced abortions;
- Survey on hospital discharges after miscarriage.

Finally, the marital formation/dissolution is given by:

- Survey on Marriages;

- Survey on Legal Separations;
- Survey on Divorces.

All those Surveys retrieve basic information on our target population such as women's name, surname and date of birth and it is possible to group all those information in one variable that can be used as the matching key in the linkage procedure between the Sample Survey on Births and all the other sources just described (Figure 2).

3 Conclusions

The use of data integration methods in demographic fields represents a real challenge for future analyses: the theoretical framework set out allows the creation of a multi-source longitudinal database that can be used both for computing cohort indicators and for establishing the connection between marital formation and dissolution and reproductive behaviour in a life-course perspective.

Among the several opportunities that data integration can offer the linkage between sample surveys and administrative sources appear to be particularly relevant since it allows to enlarge the overall information potential; furthermore thanking to its longitudinal nature it is particularly valuable for carrying out event history analyses.

Figure 1: loss and re-entries in the target population

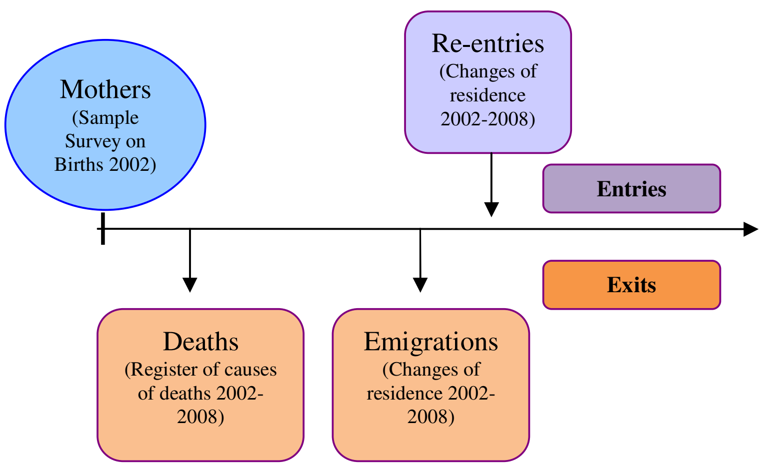
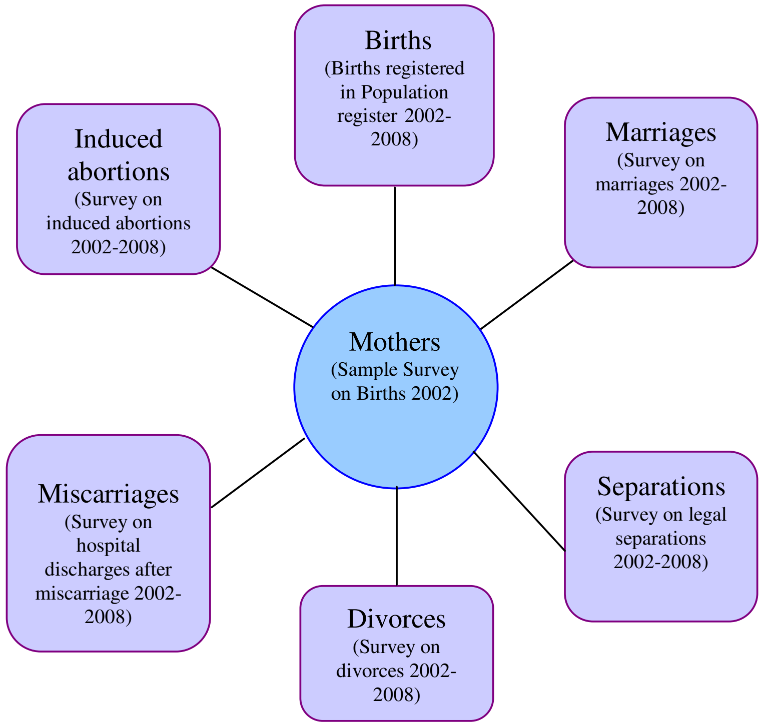


Figure 2: towards a multi-source database: sample survey and administrative data involved



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Bayesian and non-bayesian approaches to statistical inference: a personal view

Bruno Chiandotto

Abstract Bayesian and non-bayesian approaches to statistical inference are compared giving particular attention to the emerging field of causal statistical inference and causal statistical decision theory. After a brief review of the evolution of statistical inference, as extraction of information and identification of models from data, the problematic issues of causal inference and causal decision theory will be reviewed. The aim is to provide some basic ideas for unifying the different approaches and for strengthening the future of statistics as a discipline.

Prologue

About thirty years ago, in a meeting on the foundations of statistical inference, Scardovi (1978), using an image of E. Neurath (one of the guiding spirit of the circle of Vienna), defined the inductive knowledge a damaged ship, that should be repaired without interrupting the navigation: "*Dai tempi di Hume la nave ha imbarcato acqua, e ancora più filosofi. Essi ne affollano il ponte, raccolti in schiere agguerrite: induttivisti e deduttivisti, falsificazionisti e verificazionisti, empiristi e razionalisti, convezionalisti e pragmatisti, oggettivisti e soggettivisti, e di tant'altre qualità ancora. Eppure, la navigazione procede. Vi attendono gli addetti alla scienza, che tuttavia non mancano di prestare attenzione al disputar dei loici, anche per il sopraggiungere di strani personaggi non proprio filosofi e nemmeno tanto scienziati. Divisi in fazioni irriducibili, costoro si affaccendano tra il ponte e le stive, un po' intenti all'andar per mare, un po' presi da quel vivace argomentare, e comunque pronti a calar scialuppe. Sono gli statistici.*" Today the ship is still damaged but the sailors, of different races, are many more.

Hume (1739) argued that induction is irrational. This view, often called Humean irrationalism, conflicts with the empiricist view that affirms that science proceeds in a rational and inductive way. Many attempts have been made to refute Hume. One of the earliest is due to Bayes (1764) and Laplace (1812). According to Bayes, rational learning proceeds by assigning probabilities, usually called prior probabilities, to hypotheses. Using Bayes's theorem, these prior probabilities are then updated in the light of experience. In Laplace's account, the precise meaning of the prior probabilities was unclear; to determine these probabilities, Laplace used what is often called the *principle of insufficient reason*.

Subsequently, the Laplacian account of rational learning was criticized as applying the same intuition to a different representation of the problem often yields different probabilities. Keynes (1921) and Carnap (1950) tried to improve Laplace's approach by interpreting the prior probabilities as a measure of quantifying logical relations between

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statements. They did not succeed; the logical probabilities proved to be non-unique. While Keynes and Carnap unsuccessfully tried to save the Bayes-Laplace tradition, there emerged an alternative conception of rational learning that did not rely on prior probabilities. Fisher (1930, 1935, 1956) and Popper (1934) sharply rejected the Bayes-Laplace tradition and proposed other solutions to the problem of rational learning.

With his theory of significance testing, Fisher revolutionized statistical theory and practice. Meanwhile, Popper developed the falsificationist methodology and had a similar influence on the philosophy of science. Both solutions to the problem of rational learning are based on the same principle, namely, that it is rational to accept hypotheses if they have survived rigorous testing. In Popper's terminology, such hypotheses are called corroborated. A similar approach is due to Gini (1943)[1] and Pompilj (1948, 1961).

1 Introduction

The history of statistical inference is marked by controversies about its fundamental principles. Historically, one can consider roughly four principal approaches to statistical inference. The division into different approaches is mostly based on the weights given to the cultural values of each.

The first approach is called Fisherian. Fisher has emphasized the need for a variety of approaches for different problems; he was dismissive of axiomatic arguments. A second approach due to Neyman and Pearson (1928), initially developed to explain Fisher's ideas more concretely, is strongly based on the frequency theory of probability and emphasize operational concepts. A third approach, where probability represents a rational degree of belief, in which different people faced by the same evidence share the same probability, goes back to Laplace and his predecessors and in its modern form it is associated with Carnap and, especially, with Jeffreys (1939). This (*obiective*) approach has been extended by specific characterization of probability in which the degree of belief is constrained only by the requirement of self-consistency. In this fourth approach, (*personalistic or subjective*), associated with Ramsey (1931), Good (1960), de Finetti (1937) and Savage (1951, 1954), there is no assumption that different people with the same knowledge express the same probability on a specified event.

In the first two approaches the procedures are justified by their performance under hypothetical repetitions of the experiment, i.e. frequency properties. The differences between the two are minor, and are essentially the following:

- in the Fisherian approach, emphasis is placed on the simple test of significance, on the likelihood function and principles as sufficiency;
- in the Neyman-Pearson approach, operational requirements, such as power and other explicit indicators of sensitivity, are emphasized and confidence interval and acceptance and rejection of hypotheses terminology is introduced.

Between the two schools, usually referred as *classical theory of statistical inference*, there is a difference in the attitude to what philosophers call the problem of the unique case. Jeffreys's approach to inference has the same target as Fisher's: what can be

[1] On the contributions of Gini to the foundations of probability and statistical inference I strongly recommend a forthcoming paper by Piccinato (2011a).

reasonably learned about a parameter of the hypothesized model from the data? But, in contrast to Fisher, Jeffreys argues that a different notion of probability is needed to achieve this, specifically, a reasonable degree of belief computed by means of Bayes's rule; the a priori distribution is taken, in accordance with Laplace, to be dispersed, representing lack of knowledge. In many situations, the Neyman-Pearson and the Jeffreys approach provides the same answers as the Fisher's approach.

Jeffreys's and the personalistic approach are often referred to as *Bayesian (or neo-bayesian) approaches to statistical inference*. Although they are formally the same, there are some fundamental and philosophical differences: the personalistic degree of belief, in contrast to the reasonable degree of belief, measures how strongly you believe in something in the light of the model for the data; the direct consequence is that the choice of the prior is substantially different (see Piccinato, 2011b for details).

There are other approaches to statistical inference in which the methodological systems use procedures not encountered in the classical-bayesian classification; of these alternative approaches some represent new ways of looking at statistical information, others a different way of interpreting them. The most relevant are: fiducial inference, likelihood inference, plausibility inference, structural inference, pivotal inference, prequential inference and predictive inference (see Barnett, 1999 for details).

All the approaches to statistical inference utilize some kind of information to obtain a description (through a statistical model) of the phenomenon under study. If large amounts of data are available, the different approaches usually lead to close results though their interpretation still depend on the paradigm by which they are generated. For small samples, however, the numerical answers can differ substantially and guidelines are needed to reach a compromise operationally useful. Consequently, it is necessary to be able to pinpoint the similarities and differences between the different approaches. In my view, every approach, with the aim of suggesting actions to be taken in practical situations, should be based on mathematical models that should accommodate all the different approaches and can provide tools for making comparative analyses. Such an approach is the ***decision approach*** substantially already present in the Neyman-Pearson theory. Moreover, the decision approach gives a satisfactory solution so far, at the so called *pragmatic problem of induction*.

Based on Neyman-Pearson's theory of hypothesis testing, which emerged from a criticism of Fisher's theory of significance testing, a statistical decision theory was originally developed by Wald (1950). According to statistical decision theory, the decision maker should choose a strategy under the assumption that an adversary determines which of the possible hypothesis from a set of alternatives is true. If it is assumed that the adversary, often called *nature*, makes its choice knowing the strategy chosen by the decision maker, the selection of the strategy is made by comparing the expected outcome of each strategy. Assuming that an adversary selects the true hypothesis removes the indeterminateness concerning the probability distribution, in this case, the theory presupposes known the probability distributions.

Many authors (Cox, 1958; Smith, 1965; Barnett, 1999) affirm that a distinction must be made between statistical inference and statistical decision theory. But some authors such as Lindley (1965, 2006), and this is also my opinion, consider statistical decision theory as one of the possible extensions of statistical inference. Moreover, the decision approach, combining various theories of statistical inference, avoids dogmatisms that can lead to paradoxical situations. It is free from logical error, is more effective in applications and treats successfully a broader range of problems than competing approaches.

Utility and causality play a central role in statistical decision theory as in almost all modern sciences, in theoretical as well in empirical contexts. In the next paragraphs, after some considerations on Bayesian statistical inference, I offer a sketch of different theories of causation and how they could be utilized in statistical decision theory.

2 Bayesianism

A problem for the frequentist or classical statistical inference is the so-called problem of the single case. The classical school recommends statistical methods that imply low probabilities of making certain errors, for instance, the error of rejecting a true hypothesis. According to the frequentist theory, the probability of rejecting a true hypothesis is the limiting relative frequency of committing this error in an infinite sequence of applications of the method. The problem of the single case undermined the whole theory of probability upon which the rejection of the Bayes-Laplace tradition was built and the problem of the decision criterion opened the door to the use of prior probabilities. Bayes himself had already proposed a justification for attaching prior probabilities to hypotheses. This justification was lost in Laplace's version of the theory. However, even before the advent of the Neyman-Pearson theory of statistical inference, Ramsey (1931) and de Finetti (1937), independently of each other, criticized the theories of frequentist probability and logical probabilities, coming up with a subjectivist version of the logical theory, embracing the non-uniqueness of logical probabilities as an expression of personal beliefs.

Even if the most influential version of neo-bayesianism has been proposed by Savage, the term Bayesianism is used in a wider sense than Savage's approach. It includes the logical probability, frequentist probability and some other attempts to objectify prior probabilities. Savage dealt with statistical inference, statistical decision theory and the axiomatic theory of decision making under risk, which he extended in a way already anticipated by Neumann and Morgenstern (1947). Savage showed that a reasonable preference order over the set of all conceivable strategies can be represented by expected utilities of strategies, where now not only the utilities, but also the probabilities for computing the expectations can be derived from the preference order. Substantially, Savage provided a general theory of rational learning and decision making. The relevance of neo-bayesianism, where all probabilities are the subjective degrees of belief, lies in the fact that it is a very general philosophy that seamlessly covers science and decision making starting from the problem of induction. Bayesian rationality constitutes progress beyond Humean irrationalism. Even if Bayesianism is not helpful when nothing is known, it might be helpful in the case of partial rather than complete prior information (Joyce, 2011).

Real-world decision problems often have to be simplified to become tractable. In such cases, it seems that experts may hit on strategical simplifications because of their prior experience. According to contemporary model-building wisdom, *finding the right simplifications is an art, not a science*; it involves knowledge and requires experts in the field, this conviction is widely shared by experts. Bayesianism, it seems, gives the experts a possibility to bring their experience to bear on the problem. They can choose a prior probability measure in the light of their experience. Given this choice, which can be communicated to others, decision making can proceed, if the computations are feasible; if not, one can try to find an approximation. Indeed, model building is itself a matter of approximation; Bayesian experts might construct simplified models by excluding possibilities that they assign, in the light of their experience, a low prior probability. Thus, it could be argued that Bayesianism describes a rational way of expressing partial expert knowledge that cannot easily be expressed in another way. However, Bayesianism leaves in the dark how experts proceed when trying to transform experience into a prior. On the other hand, experts might learn from experience in a rational fashion. In this case, we already know how ideal Bayesian experts proceed. They start with a prior probability before making experiences, updating their prior, and when after some time they are viewed as experts, the prior they bring to a new problem is actually a posterior probability measure embodying their experience. The problem with this analysis is, however, that the everything-goes theorem implies that the expert's posterior is arbitrary. According to Bayesianism, all conclusions drawn from experience are equally reasonable or unreasonable. There is no reason why the prior probability measure chosen by an expert should be better or worse than the one chosen by another expert.

3 Decision theory and utility

The foundations of the (normative) modern statistical decision theory, as already said, is due to Von Neumann and Morgenstern (Expected Utility- *EU*) and Savage (Subjective Expected Utility **–** *SEU*). These authors, on the basis of a series of postulates, or rational axioms of behavior of the decision maker, prove the existence of a real valued utility function that can be derived from the betting rule.

Decision theory is a theory about how decision makers should, rationally, direct their activities. Given a set of options or acts constituting a decision problem, decision theory recommends an act that maximizes utility, that is, an act whose utility equals or exceeds the utility of every other act. It evaluates an act utility by calculating the act expected utility. It uses probabilities and utilities of an act possible outcomes to define an act expected utility.

Since people usually do not behave in ways consistent with the *axiomatic* rules and hence lead to violations of optimality, there is a related area of study, called a *descriptive decision theory*, attempting to describe what people actually do. The two approaches are closely linked, the normative optimal decision often creates hypotheses for testing against an actual behavior. Furthermore, it is possible to relax the assumptions of perfect information, rationality and so forth in various ways, and produce a series of different prescriptions or predictions about behavior, allowing for further tests of the kind of decision-making occurring in practice.

A series of criticisms (particularly Allais, 1953 and, for an up-to-date and reasonably extended review, Chiandotto and Bacci, 2004) have been made against *EU* and *SEU*. The criticisms regards, mostly, the empirical relevance of the rational axioms of behavior.

Even if the problem of the importance of the axioms on the behavior of the decision maker has to be viewed not in the sense of a good description, but in that of a good rule (i.e., it concerns identifying the best decision to take, assuming an ideal decision maker who is fully informed, able to compute with perfect accuracy, and full rationality) different authors have proposed alternative systems of axioms less restrictive and more compatible with the actual behavior of decision makers.

To generalize the normative decision theory, some authors adopted different terminology like *prescriptive decision theory* (Bell at al., 1988), *constructive decision theory* (Roy, 1993; Tsoukiàs, 2007).These approaches characterize themselves for the ideal rules of rational behavior that should be able to be translated in directly operating tools. The prescriptive and constructive theories are therefore orientated to match the rational with the effective behavior of the decision maker. These models hypothesize weaker axioms than the classic ones; in particular, since the more frequently violated axiom is independence, the new theories release the property of linearity in the probability. Machina (1982), develops a utility theory without the presence of the independence axiom. Other theories, instead, do not include the axiom of transitivity (Fishburn 1973). Among the more interesting theoretical proposals (generalization of utility theories) we should include the rank dependent utility (Quiggin 1993), the prospect theory (Kahneman and Tversky 1979) and cumulative prospect theory (Tversky and Kahneman, 1992). Aiming at giving to decision theory useful operating tools, it must be considered the so-called causal approach to the theory of the decisions. This approach, as we will see in the next section, although mainly developed in the context of the philosophical reflection, results of large interest for his statistical implications.

4 Causality

In spite of the innumerable developments, some of them resumed in the previous section, generalized utility theories are still not able to solve in a satisfactory way operative decision-making problems. In fact such theories discus situations in which the consequences of acts are dependent of the *state of the world* whenever the action chosen have no effect on such state. This hypothesis that in many contexts is not satisfied. In fact, in many situations the choice made by the decision maker has a, sometime, relevant effect on the state of nature (the act causes the state). Therefore, to solve decision problems, the analysis of causality becomes relevant in its theoretical aspects and in its operative implications.

Regarding causality, the paper of Freedman (1999) and three contributions of Mealli, Pacini and Rubin (2011), Cox and Wermuth (2004) and of Frosini (2006), are especially useful. This latter author presents a synthetic but exhaustive panorama of the developments of the concept of causality: starting from the Aristotelian doctrine of causation he arrives to the more recent developments on relevant aspects to statistical modeling and, particularly, on acyclic graphical models (*Directed Acyclic Graphs – DAGs*). Also Cox and Wermuth, after an interesting close examination of three different definitions of causality, analyze graphical models focusing on the concepts of statistical independence and particularly on the difference between conditioning and intervention.

The paper of Mealli, Pacini and Rubin, gives a complete and up to date account of the so called Neyman-Rubin-Holland model of causality. The framework proposed especially by Rubin (Rubin, 1974, 2004; Holland and Rubin, 1983) is very powerful and general, it provides a definition of causal effects in terms of potential outcomes, as well as a general statement of the assumptions, sufficient to make causal inferences possible, even with observational data. Unfortunately, because of its generality the standard Neyman-Rubin-Holland model operates at a level of abstraction that is far away from the underlying mechanisms and processes that account for how observational data are generated. While such generality makes the model very powerful, its agnosticism about the underlying causal mechanisms can make it difficult to be applied in settings that are not close to a well-designed experiment.

Graphical models represent no doubt a generalization of the graphs of influence (Howard and Matheson, 1984; Dawid, 2002) that represent an extension of the path diagrams proposed by Wright (1921). In path analysis, the connections among the variables of interest are expressed in a graphical form, allowing to distinguish spurious from causal, direct and indirect effects, of variables. Others very interesting contributions to the statistical analysis of causality are Dawid (2000), Holland (1986), Spirtes, Glymour, Scheines (1993), Lauritzen and Richardson (2002), Heckman e Vytlacil (2005) and, above all, Woodward (2003).

Woodword collects in his volume a thirty-year of research activity presenting a new theory of causality that he considers superior to the counterfactual theory of causality developed by Lewis. The contribution of Woodword is placed in line with the studies of Spirtes, Glymour and Scheines and of Pearl. While these latter authors concentrate their attention on the theoretical-methodological aspects, Woodword deals particularly with the philosophical foundations of the reasoning introducing a simple, but clear, definition of causality: *C* causes *A* if and only if the value of *A* is modified by an intervention on *C*. Woodword presents the tools for the analysis, graphics and equations, for proceeding to the development of its *theory of Manipulation*.

The different approaches to causality outlined above are characterized by specificities that are considered by the authors themselves not compatible: each author considers his own approach to be superior to the others. In my opinion, this position does not appear acceptable, as many of them are compatible at least in some fundamental aspects. Regarding superiority, it does not exist a statistical tool of universal validity able to give a satisfactory solutions in all research frameworks. The combined use of different approaches (White and Chalak, 2006) seems the correct route to pursue for achieving the more interesting and significant results.

With regard to the combined utilization of different approaches it is convenient to recall the considerations made by Lauritzen (2004). This author in the discussion to the work:" *Direct and Indirect Causal Effects via Potential Outcomes"* of Rubin (2004)., said: *"….In the modern revival of interest in causal inference in statistics, a number of competing formalisms prevail such as structural equations ....., counterfactual random variables ..., or potential responses ... .. Much energy has been used to promote the virtues of one formalism versus the other, seemingly without coming nearer to a consensus;... . Professor Rubin's paper advocates the use of potential responses in contrast to graphical models, illustrated with a discussion of direct and indirect effects in connection with the use of surrogate endpoints in clinical trials. Although discussions* *of this nature can be used to sharpen the minds and pinpoint important issues, I find them generally futile. Personally I see the different formalisms as different 'languages'. ....., and I have no difficulty accepting that potential responses, structural equations, and graphical models coexist as languages expressing causal concepts each with their virtues and vices."*

5 Causal Decision theory

How much what we have said about causality can be relevant in the decision-making context? Causal decision theory adopts principles of rational choice that attend to an act consequences. It maintains that an account of rational choice must use causality to identify the considerations that make a choice rational. An act expected utility is a probability-weighted average of its possible outcome utilities. Possible states of the world that are mutually exclusive and jointly exhaustive, and so form a partition, generate an act possible outcomes. An act-state pair specifies an outcome. Each product specifies the probability and utility of a possible outcome. The sum is a probability-weighted average of the possible outcomes utilities, where the probabilities depend casually on the act, probability are causal rather than merely evidential.

Joyce (1999), in his book on *The foundations of Causal Decision Theory*, gives an account of rational decision making and probabilistic theories of evidence and confirmation. This author begins with an historical introduction to the topic of decision theory, including a critical discussion of Savage's theory, followed by a treatment of the modern *evidential theory* (Jeffrey, 1965) of decision making. Two chapters are deal with causal decision theory. The final chapter reports a unified representation theorem that simultaneously provides a firm foundation for both evidential and causal decision theory.

The accounts of rational decision discussed by Joyce presuppose that a rational agent should act so as to maximize some sort of 'expected utility', which is a sort of weighted average of the utilities of the outcomes of a decision. What's at issue in the foundational disputes is which kind of expected utility should be maximized, and, consequently, which weights should be used in the weighted average of the values of the outcomes. All parties seem to agree that the weights should be set according to the probabilities of the outcomes given that the act is performed. The disagreement concerns how to unpack this subtle conditional-like expression for the purpose at hand. Evidential decision theory recommends performing that act which provides the *best evidence* for the good outcomes (on average). On the other hand, causal decision theorists propose a different way of unpacking. They suggest that we unpack this as the degree to which the act causally promotes the state. Several interpretations of causal probability have been proposed in the literature, and the connections between the various kinds of conditionals have been studied extensively in recent decades. Obviously, as will sometimes be the case, the evidential and causal theories of decision will generate exactly the same prescriptions. However, evidential and causal conditional probability judgments can differ in important ways.

Armendt (1986), in a paper on the foundations of causal decision theory, distinguishes three different approaches to causal decision theory, similar in the contents but philosophically different, that go back, respectively to Gibbard and Harper (1976), Skyrms (1979) and Lewis (1981). All approaches are characterized by the introduction of a system of rational axioms of preference and by the presence of a theorem of existence of the utility function representative of the preferences of the decision maker. Gibbard and Harper distinguished causal decision theory, which uses probabilities of subjunctive conditionals, from evidential decision theory, which uses conditional probabilities. As in decision problems probabilities of subjunctive conditionals track causal relations, using them to calculate an option expected utility makes decision theory causal. They argued that expected utility, calculated with probabilities of conditionals, yields genuine expected utility. Skyrms presented a version of causal decision theory that dispenses with probabilities of subjunctive conditionals. His theory separates factors that the agent's act may influence from factors that the agent's act may not influence. Lewis defines the expected utility of an option and his formula for an option expected utility that is the same as Skyrms. Skyrms's and Lewis's calculations of expected utility dispense with causal probabilities. They build causality into states of the world so that causal probabilities are unnecessary. The various versions of causal decision theory make equivalent recommendations when cases meet their background assumptions.

The handy interpretation of the probability of a state if one performs an act, however, is not completely satisfactory. A good decision aims to produce a good outcome rather than evidence of a good outcome. It aims for the good and not just signs of the good. Often efficacy and auspiciousness go hand in hand. When they come apart, an agent should perform an efficacious act rather than an auspicious act. Causal decision theory interprets the probability of a state, if one performs an act, as a certain type of causal probability rather than as a standard conditional probability. This aspect makes expected utility track efficacy, rather than auspiciousness.

As already outlined, Pearl, Spirtes, Glymour, and Scheines and Woodward present methods of inferring causal relations from statistical data. They use directed acyclic graphs and associated probability distributions to construct causal models. In a decision problem, a causal model yields a way of calculating an act effect. A causal graph and its probability distribution express a dependency hypothesis and yield each act causal influence given that hypothesis. They specify the causal probability of a state under supposition of an act. An act expected utility is a probability-weighted average of its utilities according to the dependency hypotheses that candidate causal models represent.

Heckerman and Schachter (1995) proposed a version of Pearl’s causality definition in the decision-making framework. This formulation has been rejected by Pearl himself. Heckerman and Schachter some years later, discussing the work "Statistics and Causal Inference" of Pearl (2003), say:“*Unfortunately, Pearl has downplayed the strong connections between his work and decision theory as well as the suitability of the influence diagram as a representation of causal interactions. On the contrary, we believe that people who are familiar with decision theory will find comfort, as we have, in these connections.*”. The objections advanced by Pearl do not seem acceptable and the papers of Dawid (2002), Sloman and Lagnado (2005), Sloman and Hagmayer (2005), Hagmayer and Sloman, (2006), Geneletti and Dawid (2011) confirm such an impression.

6 Conclusions

The importance of Bayesianism, in which all probabilities are subjective degrees of belief, lies in the fact that it is a very general philosophy that seamlessly covers science and decision making from the problem of induction, which provides the context where it originated, to the theoretical and practical problems of statistical inference. Bayesian rationality constitutes a progress beyond Humean irrationalism. Even if Bayesianism is not helpful when nothing is known, it might be helpful in the case of partial rather than complete knowledge (Joyce, 2011).

Causal knowledge plays an important role in everyday reasoning, it enables to predict future outcomes, explain past events, control the environment. Correlations among events can often be good indicators of the presence of some causal relation, but it is well known that observed associations are insufficient to disambiguate causal structure. For this reason much of causal learning takes place in the context of intervention that, in the real world often involves learning a complex network of relations among many events (Russo, 2009; Pearl, 2011). To learn from interventions one must first decide which intervention to make.

Intervention is the central subject of the contributions of Pearl on causality. This author, in my opinion, has given the more interesting and innovative contributions to the analysis of causality, but his contributions, to become really useful from an empirical point of view, must be reinterpreted, as suggested by Heckerman and Schachter, in a decision theoretic framework. The decision-making process allows learners to use interventions to disambiguate particular causal structures, namely, those that they have in mind as potential models of the causal system. The idea is that active examination of data facilitates learning more than learning from simply observing the same data.

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Challenges and opportunities in linking sample surveys: the case of ICT and CIS

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Abstract This paper describes a research project addressing the current methodological issues in linking micro data stemming from two business surveys, Information and Communication Technologies (ICT) and Community Innovation Survey (CIS), concerning innovation in Italian enterprises. The ICT-innovation bidirectional relationships and the causality issues can be addressed in a comprehensive manner only by integrating micro-data. This project faces the challenge of deriving a statistical framework for integrating CIS and ICT survey micro-data, using suitable record linkage techniques Some methodological challenges and various advantages of linking data are highlighted in the paper.

Keywords: data integration, analyses of combined data, ICT and innovation

1 Introduction

The complex and multiple relations between the use of general purpose technology such as ICT, firms' innovation patterns and economic performances are issues of increasing importance in the empirical literature on innovation. A number of studies have focused on the complementary aspects of ICT and innovation. ICT can increase innovation by speeding up the diffusion of knowledge, by facilitating networking among firms, by reducing geographic limitations and increasing efficiency in knowledge sharing. Therefore, including ICT variables in innovation models give additional power in explaining differences in firms' likelihood to innovate and their innovation modes (Oecd, 2010). On the other side, since innovation has become more informative-intensive, cooperation-driven and network-based, the innovative firms are highly-intensive ICT users (van Leeuwen, 2008).

The ICT-innovation bidirectional relationships and the causality issues can be addressed in a comprehensive manner only by integrating different micro-level statistics that can actually help to assess the diversity of firms and to track their different behaviours within an industry. Further, micro data allow to evaluate how the various features of innovation and ICT interact in different firms.

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To this regard, research on these topics has recently tried to combine at firm-level ICT and CIS data (Oecd, 2010; Eurostat, 2008). One of the main issues still left largely un-tackled is the selectivity problem due to the initial sampling of small firms. Additionally, the negative coordination of samples diminishes the representativeness of the joint ICT-innovation data. Starting from the ongoing research in the field of micro-founded analyses outlined above, this project faces the challenge of deriving a statistical framework for the data integration of CIS and ICT micro data.

2 Linking methods

In official statistics, the data integration procedures are becoming extremely widespread due to many reasons, such as costs saving, response burden's reduction and greater information value derived from different sources. Record linkage techniques offer a multidisciplinary set of methods and practices to overcome difficulties related to combine data (ESSnet ISAD, 2008). In this project, the use of linkage techniques is suitable as the desiderate output is a unique dataset, with units common to both ICT and CIS surveys and all variables recorded. Experiences on simple merging survey data encourage in choosing record linkage among other data integration techniques due to the overlapping rate of the two surveys. The main drawback of merging is related to the sample non-representativeness since it basically involves the largest enterprises. Then, if analyses were limited to the merged file, the results could be potentially biased. Despite the negative coordination of samples, the 2008 waves of ICT and CIS surveys have a quite good overlap rate, so these favourable occasion represents a benchmark for the integration phase. In this preliminary stage, the use of probabilistic record linkage techniques implies several important advantages: it allows to build integration models that explicitly consider several error sources, it allows to obtain a microdataset and, finally, it provides a correct framework for further analyses on the integrated dataset.

Designing a data integration strategy is a very complex process. First, the definition of a common target population has to be tackled: e.g. the surveys do not refer exactly to the same population, they have different reference years, etc. Second, a careful choice of the linking variables should be made. The other phases of the probabilistic record linkage process are equally important. Additionally, since we deal with two sample surveys, differences in their design strategies have to be considered. Besides linking, important issues of creating a combined dataset have a strong impact on the output quality: to mention just the main aspects, for the sake of brevity, the imputation strategy, the non-response adjustment procedure, the weighting adjustment and the calibration procedure.

To put into practice this complex integration activities we basically plan to exploit the software RELAIS, the open-source system originally devised for record linkage (Cibella et al 2010). The last aim of our project is to stimulate analyses using integrated CIS-ICT microdata. The research potential of the CIS-ICT microdata could be further increased by enabling access to the integrated dataset. A dissemination plan will be developed, taking into account both data utility and risk of disclosure.

3 Preliminary explorative analyses

The aim of these preliminary analyses, based on simple merging dataset 2008 CIS and ICT surveys (Istat, 2009 and Istat, 2010), is to find relationships between ICT and CIS aspects in order to detect those situations in which a combination of several ICT-CIS variables is verified and, consequently, to define some consistency-relational rules for imputation procedures aimed at filling in the informative gaps the missing values among non-merged units. When merging the two datasets, we obtained a final sample of 9,882 firms operating in economic activities covered by both surveys (Table 1). The merged respondents represent half of the units included in both ICT and CIS samples, while the cases of misclassification between ICT and CIS (due to different Nace sectors or size classes) are not so relevant (only 152 cases). In some economic activities such as Financial services, data show quite different percentages due to the different sampling design of the two surveys (see sector K). Moving to the size level, as expected, merged largest firms are better represented in both ICT and CIS surveys (over 80% of total), thanks to the good response rates and the survey design covering all the largest enterprises. In any case, a good coverage at level of all classes is obtained by the merged dataset. With regard to the sectoral and size composition of the merged data, no significant bias of firms' distribution in the ICT and CIS dataset is shown.

Table 1 2008 ICT and CIS survey coverage of merged enterprises**.**

	Nace Rev 2 coverage					Size class coverage		
ICT survey	**Manuf.+ Energy**	**Constr.**	**Finan. Serv. (K)**	**Other serv.**	**Total**	**10-49**	**50-249**	**250+**
Merged enterprises	3725	2412	729	3016	9882	6357	1988	1537
% of merged on final sample	*60.44*	*46.13*	*43.89*	*44.83*	*49.96*	*44.32*	*55.72*	*82.24*
% composition of merged data	*37.69*	*24.41*	*7.38*	*30.52*	*100.00*	*64.33*	*20.12*	*15.55*
% composition of final respondents	*31.16*	*26.43*	*8.40*	*34.01*	*100.00*	*72.51*	*18.04*	*9.45*
CIS Survey								
Merged enterprises	3734	2389	729	3030	9882	6394	1963	1525
% of merged on final sample	*52.18*	*54.57*	*90.67*	*41.22*	*50.19*	*44.31*	*56.34*	*85.96*
% composition of merged data	*37.79*	*24.18*	*7.38*	*30.66*	*100.00*	*64.70*	*19.86*	*15.43*
% composition of final respondents	*36.35*	*22.24*	*4.08*	*37.33*	*100.00*	*73.29*	*17.70*	*9.01*

Preliminary explorative analyses were carried out by using a restricted set of information, each proxying a particular dimension of some ICT phenomena and innovation processes. To meet temporal comparability and analysis repeatability, for the ICT variables, several EC core benchmarking indicators were chosen: use of extranet and intranet, interaction with PA, connection to Internet via mobile phone, on-line sales and purchases; moreover, we considered some variables expressing meaningful relations among ICT and CIS to be used for imputation, e.g. the use of software applications. Similar experiences (Oecd, 2010) suggested that ICT use expressed in terms of web facilities and automatic links among internal and external systems are dimensions enabling firms to adopt innovation. The CIS variables investigated in this phase were chosen based on the relevance of their explicative power in the analyses of innovation processes, their nature and determinants. Innovation factors were classified in four macro-categories: a) indicators measuring the investments in R&D or acquisition of new/advanced technologies and machineries; b) indicators on the type of innovation outputs: products, processes, organizational and marketing innovations; c) an indicator on the cooperation for innovation, representing the interactions of firms with other institutional actors; and d) two structural characteristics: belonging to an industrial group and the presence of firms in foreign markets. Different dimension reduction techniques were carried out to find homogeneous groups of ICT-CIS variables in the merged dataset. Details will be available in an on-going paper. All the applied methods present analogous results: two groups of variables are more similar and connect the two surveys. The first group confirms some strong relations between categories a) and b) and the complementarities and interdependences within the two forms of technological innovation and between technological and non-technological innovation. The second group includes variables denoting an adoption of more advanced technologies characterizing firms using specific software applications and a more functional use of ICT to the business (enterprise offers advanced services on the website, it uses extranet to communicate with actors of own value chain). At this level of ICT usage is the link with the core of CIS variables in the first group. The relationship between CIS and other ICT variables seems to be less strong and more related to structural variables as the industrial group (increasing the need to communicate between different locations via intranet and/or mobile devices) and the presence of firms in foreign markets (buying and/or selling on-line increase the boundaries of relevant markets).

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The use of administrative data for statistical purpose: the case of structural business farm statistics

Alfredo Cirianni e Laura Esposito

Abstract The FADN-FER survey (FADN stands for Farm Accountancy Data Network, FER stands for Farm Economic Results survey) collects a large number of variables regarding economic results of farms. The results of the FADN-FER includes statistical data on economic activity of farms like production, value added, costs, subsides and employment (quantity of work). The survey is presented with schemes similar to those used for business surveys in industry and services sectors.
In this paper we compare aggregates estimated by the survey for agricultural enterprise whit the same variables present in archives collecting fiscal and administrative declarations. The main sources used for this purpose are: Tax office, National Institute for Social Compulsory Contributions (INPS) and Chambers of Commerce. Fiscal and administrative information are stratified in order to consider that different legal units have different administrative sources.
The administrative information system of structural business farm statistics is projected by the integration of farm register with the information obtained by main fiscal declarations like: Value Added Tax (VAT), Regional Direct Tax on business incomes (IRAP), direct income tax (UNICO), INPS and balance sheets.

Keywords: economic results of farms, fiscal declarations, administrative declaration, farm register.

1. The FADN-FER questionnaire

The Business Survey on Agriculture – FADN-FER survey – focuses on the economic performances of Italian agricultural holdings. Responsible of FADN-FER survey are the Italian National Statistical Office – ISTAT – and the Italian National Institute of Agricultural Economics – INEA. In particular, ISTAT is responsible for methodological issues and INEA is responsible for data collection.
Parts of the survey network are also Regions and Autonomous Provinces. Data are annually collected according to FADN (Farm Accountancy Data Network) methodology for the bigger farms (FADN) and using the FER (Farms Economic Results) questionnaire for small farms. Observation field for the FER survey are farms having less then 4 ESU (European Size Unit) with at least one hectare of Utilised Agricultural Area (UAA) or a turnover of more than 2,066 euro. Observation field for the FADN survey are commercial farms having more than 4 ESU (European Size Unit).
Units are sampled using a stratified random sample design to satisfy both FADN and ESA ‘95 regulations. Sample design variables are location, economic activity and ESU. To comply with the National Accounts (ESA95) needs the main structural variables are observed on each unit as well as economic variables (cost and revenue structure, labour cost, contributions, changes in inventories, re-uses, non marketed goods).
The FADN-FER variables, which are present in administrative source, are turnover, production value, production costs, value added, labour costs, gross operating surplus and change in stocks of finished products and raw materials.
The FADN-FER questionnaire is composed by the following sections:
• General information related to the farm enterprises

• Section II – Investment of instrumental capital, turnover and subsidies
• Section II – Employment and labour cost
• production costs structure;
• the stocks of final products and raw materials at the beginning and the end of year

The variables are based on competence accounting method and the variables are without VAT tax.
The turnover is defined by the selling of goods and services of the enterprises.
The production costs structure is composed by the following groups:

- purchases of goods and services for crops;
- purchases of goods and services for cattle;
- Purchases of fuel and oil and for maintenance of instrumental capital.

Labour cost is composed by salaries and wages and social contributions.
The value added is the difference between the production value and production costs.
The gross operating surplus is the difference between value added and labour cost.

2. The coverage of administrative sources

The integration of administrative source shows that each source has a different coverage.
In particular, the VAT source regards enterprises, characterised by a turnover upper then 2.000 euro, instead IRAP source regards firms with a turnover upper then 7.000 euro.
The source INPS DMAG (questionnaire for labour cost structure and employment of farm enterprises with only farm employees) regards enterprises with farm employees, the UNICO 2010 data, collected by Tax Office, (Agenzia delle Entrate, 2010[1]) regards partnerships -society characterised by unlimited responsibility of each member in case of loss or failure- and company capital -society, characterised by limited responsibility of each member in case of loss or failure- while simple society -elementary form of society in Italian society legislation- are excluded. The balance sheet (Dezzani et all, 1996[2]) regards only company capital.
Each source, however, has a different detail of economical variables and so it is important to consider all source in the same time because we must integrate the administrative variables, present in each source with the different coverage of the administrative sources.
The basic idea is to create an information system in order to indicate for each farm enterprise the available source and the coverage of each administrative variable.

Table 1 – The coverage of administrative sources

VAT	IRAP	INPS-DMAG	Unico	Balance sheet
turnover > 2.000	turnover > 7.000	Enterprises with farm employees	Partnerships (excluding simple society); companies capital	companies Capital
Not observed	Not observed	Not observed	Not observed	Not observed

[1] Agenzia delle Entrate (2010), Istruzioni per la compilazione del modello unico delle società di persone
[2] Dezzani, Pisoni, Puddu (1996) “Il bilancio”, editore Giuffré

3. The integration between the economic variables requested by National Accounts and the administrative variables

The information system studies the relationship between the main variables of FADN-FER survey, requested by National Accounts, and the administrative variables, which are present in VAT declaration, IRAP questionnaire, INPS DMAG declaration, balance sheet and UNICO questionnaire of partnerships with complete accounting system and partial accounting system. The complete accounting system regards enterprises with turnover upper than 516.456,90 euro and the partial accounting system regards the enterprises with turnover less than 516.456,90. The company capital has always a complete accounting system.
The turnover is present in all administrative source. For all sources time of recording for turnover is on accrual basis except for VAT declaration which uses a cash basis. The accrual method consists in the attribution of turnover to the period when the turnover is referred and not in the period when the turnover is cashed. The SNA93[3] recommends recording flows on an accrual basis throughout.
The changes in stocks of finished products and work in progress are present in balance sheet and a part of this variable is present in UNICO questionnaire.
The changes in stock of raw materials is present in balance sheet and only a part of this variable is present in UNICO questionnaire.
The production value is present in balance sheet and this variable is not complete in UNICO questionnaire, caused of the absence of capitalised production and other income (excluding a specific accounting variable of balance sheet called subsidies).
The production costs are present in balance sheet, in UNICO questionnaire and in IRAP questionnaire.
The value added and the gross operating surplus are algebraic differences and those variables are present in balance sheet. The value added and the gross operating surplus are partially present in UNICO questionnaire because of the absence of some variables in production value definitions.
The labour costs are present in INPS-DMAG questionnaire, in balance sheet and in UNICO questionnaire.
The employees are present in the end of note of balance sheet and in INPS-DMAG questionnaire.
In conclusion, the balance sheet are the most complete administrative source, also if the rate of coverage is lower because it is referred only to company capital.
The IVA and IRAP sources has the higher rate of coverage but they only consider one or two administrative variables.
The INPS DMAG has labour costs and employees variables but also it have salaries (which are present also in balance sheet) and the number of worked hours.

Table 2 - The integration between the economic variables requested by National Accounts and the administrative variables

National accounts	Balance Sheet	UNICO of partnerships with Complete accounting system	UNICO of partnerships with Partial accounting system	IRAP	INPS DMAG	VAT
Turnover	present	present	present	present	absence	present
Production value	present	partial present	partial present	absence	absence	absence
Production costs	present	present	present	present	absence	absence
Value added	present	partial present	partial present	absence	absence	absence
Labour costs	present	present	present	absence	present	absence
Gross operating surplus	present	partial present	partial present	absence	absence	absence
Employees	present	absence	absence	absence	present	absence

4. Conclusions

The paper deals with the use of administrative data in order to project an information system of business farm statistics.
The administrative sources are the VAT declaration, the IRAP declaration, the INPS-DMAG questionnaire, the UNICO questionnaire and balance sheet.

3 System of National Accounts (1993)

The analysis of administrative source coverage and the study of economical variables estimated with FADN-FER as requested by National Accounts show that balance sheet has the more complete set of variables but the coverage is lower because balance sheet regards only company capital. The UNICO questionnaire regards partnerships (excluding simple society) and company capital but definitions used are different from those requested by National Accounts. The IVA and IRAP declarations have very high coverage but they contain only one or two economical variables.

The INPS-DMAG questionnaire regards enterprises with farm employees and it contains very important variables (wages and salaries and number of hours worked, labour cost and number of employees).

References

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L’estensione della contabilità nazionale per includere gli aspetti sociali ed ambientali

Marisa Civardi e Cesare Costantino

Abstract After the international standard for national accounts had been set out in 1953, Stone’s suggestion to represent the accounts in matrix form was endorsed in 1968. Next step was the introduction of the Social Accounting Matrix (SAM). This can be seen as a clear and synthetic extension of input-output tables characterized by a flexible structure, thus allowing analytical work based on national accounts to go more in depth. For interpretative purposes, implementing the SAM through a set of satellite accounts covering socio-economic and environmental aspects is a crucial point, given the increasing awareness of the importance of society-environment interactions. Following Agenda 21, the 1993 SNA provided the basis for conceptual and methodological work based on which the SEEA 2012 is being prepared as the international standard for environmental-economic accounting. In the European context, the “GDP and beyond” process has provided impetus for work in this field, resulting in a European regulation ready to be adopted for making it mandatory to produce environmental accounts data on a regular basis.

1 L’estensione della contabilità nazionale tra Matrice di contabilità sociale e conti ambientali

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Gli sforzi compiuti negli ultimi decenni per dare uno spazio significativo nell'ambito della contabilità nazionale alla rappresentazione di fenomeni rilevanti sotto il profilo sociale e dal punto di vista ambientale hanno seguito percorsi diversi che, inevitabilmente, hanno anche prodotto esiti diversi. Per quanto riguarda l'ambiente, nell'arco degli ultimi venti anni si è delineato un chiaro percorso, pur con alterne vicende, che ha fatto della contabilità ambientale una disciplina dai contorni ben definiti e ha dato luogo a uno specifico settore della produzione di statistiche ufficiali. Tale percorso si presta ad una narrazione di tipo storico, ancorché nei limiti di un arco temporale che è inferiore ad un trentennio, e in tale chiave vengono proposti i paragrafi dal 5 al 7[1], dedicati appunto ai conti ambientali.

Sul versante sociale, la consapevolezza della opportunità di adottare una visione globale del funzionamento del sistema economico è sfociata nella proposta di costruzione della Matrice di contabilità sociale (SAM), e, cioè, di uno schema che organizza in un quadro contabile in modo logicamente coerente i flussi in valore che corrispondono alle transazioni che hanno luogo dentro il sistema economico. La SAM costituisce un tentativo ambizioso di integrare all'interno di un quadro unitario, gli aspetti economici, sociali e ambientali. La riflessione sviluppatasi in tale direzione, tuttavia, nel nostro paese non si è tradotta in avanzamenti operativi paragonabili al caso della contabilità ambientale. I paragrafi dal 2 al 4[2], dedicati a questo argomento, sono dunque focalizzati sugli aspetti concettuali più rilevanti per l'analisi macroeconomica.

2 La genesi della Matrice di contabilità sociale

Dopo le regole formulate nel 1953 dalle Nazioni Unite per "standardizzare" definizioni e metodi di stima nella costruzione di un Sistema di Conti Nazionali (System of National Accounts and Supporting Tables, 1953), si dovrà aspettare fino al 1968 prima che la Contabilità Nazionale accolga il suggerimento di Stone di rappresentare i conti in forma matriciale così da ottenere una disaggregazione più spinta dei conti[3].

La formulazione di regole comuni, tuttavia, avvenne senza che le Nazioni Unite accompagnassero tali regole di "standardizzazione" con la costruzione dei singoli conti all'interno di uno schema organico ed integrato, nell'ambito di una impostazione "rispettosa della teoria macro-economica"[4.] Si era preferito, invece, privilegiare l'obiettivo di produrre informazioni quantitative sempre più disaggregate ed attendibili.

In questi ultimi anni, d'altra parte, soprattutto in ambito europeo si è assistito ad un rinnovato interesse nei confronti di indicatori macroeconomici quali il rapporto debito pubblico PIL, il rapporto disavanzo corrente PIL, la pressione fiscale. Il valore di questi parametri è stato considerato alternativamente come variabile obiettivo o come variabile di controllo della dinamica del sistema economico. In particolare, per ottemperare agli accordi di Maastricht sono stati privilegiati obiettivi di stabilità macroeconomica cui subordinare le misure di politica economica fiscali e monetarie. Molto più raramente si è tenuto conto di altri effetti importanti quanto la stabilità o la

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[1] Parte redatta da Cesare Costantino.

[2] Parte redatta da Marisa Civardi.

[3] Si veda SNA 1993, SEC 1995.

4 Si veda Ferrari (1998), pag.3.

crescita, quali, ad esempio, i mutamenti nella distribuzione personale dei redditi indotti da quelle stesse politiche e il loro impatto sull’ambiente. I tradizionali schemi di natura aggregata, d'altra parte, non consentono questo tipo di analisi ed è necessario, invece, disporre di schemi di analisi volti ad integrare le informazioni relative alla produzione, alla domanda intermedia e a quella finale con informazioni relative alla distribuzione del reddito tra ed all'interno dei diversi settori istituzionali (famiglie, imprese, Stato, Resto del Mondo, Natura).

Lo strumento adeguato per conseguire questo obiettivo è rappresentato dalla Matrice di Contabilità Sociale (SAM). La prima SAM fu realizzata da Brown e Stone all'inizio degli anni Sessanta per la Gran Bretagna. Essa fu utilizzata come supporto informativo per l'elaborazione e la soluzione delle prime versioni del "Cambridge Growth Project" ed ha subito a partire da quel momento numerose elaborazioni, rielaborazioni ed applicazioni[1].

Nel 1962 Stone fornisce le indicazioni per costruire la Matrice di Contabilità Sociale partendo da una visione globale del funzionamento del sistema economico. Si tratta di uno schema che organizza in un quadro contabile e in un quadro contabile in modo logicamente coerente i flussi in valore che corrispondono alle transazioni di un sistema economico. Il punto di partenza é costituito dai flussi elementari che intercorrono tra i singoli soggetti economici riaggregati a diversi livelli[2]. Nella formulazione originariamente proposta da Stone la SAM non solo cattura la complessità del sistema economico ma riflette anche una precisa "visione" del mondo[3]. Essa può essere considerata come una vera e propria derivazione e "formalizzazione" del tradizionale modello keynesiano.

La SAM costituisce, innanzitutto, uno schema di analisi per effettuare indagini "strutturali", se così si può dire, della distribuzione personale dei redditi. Essa consente, infatti, di collegare in modo sistematico il grado di diseguaglianza nella distribuzione del reddito disponibile delle famiglie alla composizione settoriale e funzionale del valore aggiunto e, cioè, alla distribuzione primaria del reddito. Essa costituisce anche la base per la costruzione di modelli di stampo keynesiano ed, alternativamente, di equilibrio economico generale calcolabile (CGE). La caratteristica che accomuna entrambi i tipi di modelli é quella di essere multisettoriali.

La maggior parte del lavoro empirico, e cioè la vera e propria costruzione dei modelli, è stata condotta a partire dagli anni Settanta nell'ambito di Organismi Internazionali, come la Organizzazione Internazionale del Lavoro (ILO), ma soprattutto da parte della Banca Mondiale di Ricostruzione e Sviluppo (World Bank)[4]. Questi modelli sono stati impiegati in alternativa a quelli tradizionali macro-econometrici per pianificare il processo di sviluppo in paesi caratterizzati da rilevanti squilibri nella distribuzione settoriale e personale del reddito. Essi consentono di simulare e di "quantificare" gli effetti di politiche alternative (tariffarie, fiscali, di spesa pubblica) e di evidenziare gli effetti distributivi e redistributivi dei diversi mutamenti che intervengono nella struttura produttiva ed occupazionale[5].

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1 Si veda: Cambridge University Press (1962-1974). Ed anche: Stone (1951-52, 1962, 1986).
2 Si veda Stone (1951-52, 1962).
3 Si veda Ferrari (1998), pag.3
4 Le prime applicazioni furono effettuate dall'ILO nell'ambito delle missioni in Colombia, Iran e Sri Lanka, e dalla World Bank. Per una rassegna di questi modelli si rimanda a: Pyatt, Round (1985), Dervis, De Melo, Robinson (1982), Robinson (1989), Caroleo (1989), Targetti Lenti (1990), Bottiroli Civardi e Targetti Lenti (2008).
5 Si veda: Teekens (1990), pag. 2.

3 La SAM come schema di rappresentazione del circuito economico

La SAM può considerarsi un'estensione del tradizionale schema delle interdipendenze settoriali. Essa aggiunge quelle matrici che consentono di chiudere il modello di Leontief tenendo conto delle relazioni, tradizionalmente assenti nell'input-output, tra distribuzione fattoriale, distribuzione personale del reddito e composizione della spesa per consumo. La distribuzione primaria del reddito alle famiglie è intesa come strettamente connessa con la fase di produzione del valore aggiunto, nell'ambito d'una specifica struttura del sistema economico articolato in diversi settori di produzione. La distribuzione secondaria invece, e cioè quella del reddito disponibile, risulta determinata in un momento logicamente successivo, una volta che si tenga conto degli effetti delle politiche dello Stato, che attua un'azione redistributiva mediante trasferimenti positivi e negativi, diretti ed indiretti alle diverse categorie di percettori.

L'introduzione di conti intestati alle istituzioni (famiglie, imprese, Stato, Resto del Mondo) consente di cogliere il passaggio dalla distribuzione fattoriale alla distribuzione personale del reddito. Il reddito disponibile delle istituzioni, ed in particolare dei gruppi di famiglie variamente specificati dal punto di vista socio-economico, costituisce la base per alimentare le diverse componenti della domanda, ed in particolare quella per consumi delle famiglie. Il reddito che non viene immediatamente speso viene risparmiato e va ad alimentare il conto di formazione del capitale.

Per poter rispettare l'impostazione generale della SAM la rappresentazione matriciale dei flussi deve avvenire in conformità ad alcuni principi. Innanzitutto deve essere rispettato il principio base della contabilità nazionale e cioè quello secondo cui ad ogni entrata corrisponde una spesa. L'intersezione tra un conto situato sulla riga j e quello situato sulla colonna k rappresenta il valore delle transazioni monetarie che intercorrono tra di essi e, per definizione, ogni transazione è vista sotto il duplice aspetto di uscita (costo), per il conto di colonna, e di entrata, per il conto di riga.

In secondo luogo la specificazione dei settori istituzionali in cui sono raggruppati i diversi soggetti economici deve rispondere ad alcuni criteri di omogeneità in relazione alla natura del soggetto ed a quella delle transazioni. Per questo i conti di riga e di colonna vanno intestati ai settori d'attività, ai fattori di produzione (lavoro, capitale, risorse naturali), ed ai diversi settori istituzionali (famiglie, società e Stato), nonché al conto della formazione del capitale ed al Resto del Mondo. Il passaggio dai conti per settore produttivo ai conti per settore istituzionale costituisce l'elemento caratterizzante ed innovativo della SAM sia rispetto alla contabilità nazionale sia rispetto alle tavole input-output. Questa classificazione consente anche di tener conto delle tre funzioni essenziali d'ogni sistema economico e cioè quello della produzione dei beni, del consumo degli stessi e dell'accumulazione del capitale.

Dal punto di vista formale, la SAM si presenta come una matrice quadrata.

$$\mathbf{T}=[\mathbf{t}_{jk}]$$

Poiché ogni coppia riga-colonna riproduce la contabilità dell'operatore intestatario del conto, essa risulta bilanciata così che il totale di riga è uguale al totale della corrispondente colonna. Questa seconda restrizione può essere scritta come:

$$\mathbf{Te}=\mathbf{y}=\mathbf{T'e} \qquad (1)$$

dove **e** è un vettore unità così che l'elemento j-esimo del vettore **y** rappresenta sia il reddito totale sia la spesa totale del conto j.

Figure 1: Schema di una SAM semplificata

	Spese / Entrate	Attività	Fattori	Istituzioni			Risp/ Invest.	Imposte Indirette	Resto Mondo	Totale
				Famiglie	Società	Stato				
	Attività	**T1,1**	**0**	**T1,3**	**T1,4**	**T1,5**	**T1,6**	**0**	**T1,8**	**y1**
	Fattori	**T2,1**	**0**	**0**	**0**	**0**	**0**	**0**	**T2,8**	**y2**
ISTITUZIONI	**Famiglie**	**0**	**T3,2**	**T3,3**	**T3,4**	**T3,5**	**0**	**0**	**T3,8**	**y3**
	Società	**0**	**T4,2**	**T4,3**	**T4,4**	**T4,5**	**0**	**0**	**T4,8**	**y4**
	Stato	**0**	**T5,2**	**T5,3**	**T5,4**	**T5,5**	**0**	**T5,7**	**T5,8**	**y5**
	Risp/Inv	**0**	**0**	**T6,3**	**T6,4**	**T6,5**	**0**	**0**	**T6,8**	**y6**
	Imposte Indir.	**T7,1**	**0**	**T7,3**	**T7,4**	**T7,5**	**0**	**0**	**0**	**y7**
	Resto Mondo	**T8,1**	**T8,2**	**T8,3**	**T8,4**	**T8,5**	**T8,6**	**0**	**0**	**y8**
	Totale	**y'1**	**y'2**	**y'3**	**y'4**	**y'5**	**y'6**	**y'7**	**y'8**	

Scegliere quali conti rappresentare in una SAM e quale grado di disaggregazione adottare dipende sia dall'obiettivo dello studio sia dalla disponibilità di informazioni statistiche. Si tenga presente comunque che mentre in una SAM devono sempre essere rappresentati con il maggior grado di dettaglio possibile il reddito e la spesa delle istituzioni e la struttura delle attività produttive (Tavola I-O), il grado di dettaglio delle restanti informazioni dipende dalle caratteristiche socioeconomiche del sistema, dalle implicazioni di politica economica e, naturalmente, dalla disponibilità delle informazioni. La flessibilità della matrice non riguarda tanto la scelta dei conti, e quindi delle fasi del processo economico che si vogliono evidenziare, quanto piuttosto la possibilità di disaggregare gli intestatari dei conti ricorrendo di volta in volta al criterio di classificazione più opportuno[1].

Lo schema di figura 1 pur rappresentando una SAM molto semplificata, evidenzia le principali relazioni che intercorrono tra i diversi conti in esso rappresentati. Innanzitutto, come si vede, per i conti intestati alle Istituzioni la distinzione adottata è di carattere molto generale. Nello schema infatti le istituzioni nazionali sono distinte in famiglie, società e Stato (Pubblica Amministrazione) e sono separate da quelle intestate ai soggetti economici non residenti, raggruppati tutti in un unico conto intestato al Resto del Mondo. Inoltre, i tre conti intestati alle istituzioni interne registrano i soli flussi di parte corrente mentre i corrispondenti flussi in conto capitale sono condensati in un unico conto; nessuna distinzione invece viene introdotta per i flussi che fanno capo al settore estero.

In ogni cella che, è forse opportuno ricordarlo, non si configura necessariamente come uno scalare ma che, come conseguenza di ulteriori disaggregazioni non illustrate nello schema, assume generalmente la forma di un vettore o di una matrice, è riportato il valore monetario delle transazioni che intercorrono tra il conto di riga e quello di colonna; quando tra due conti non sussistono transazioni in essa appare uno 0.

La natura di quadro contabile della SAM di fig. 1 risulta immediatamente evidente se ci si sofferma sul significato economico di ogni riga e colonna. Iniziando dalla lettura della matrice per righe, si osserva che la prima, che impone l'uguaglianza tra produzione totale delle attività produttive e domanda totale, rappresenta il conto di equilibrio tra beni e servizi. In particolare, nella prima cella trova collocazione la domanda intermedia, cioè matrice delle transazioni interindustriali così come compare nella tavola I-O. La seconda cella è vuota, in quanto i fattori non rivolgono al sistema produttivo alcuna domanda di beni.

Particolarmente interessante è il blocco di matrici formato all'incrocio della prima riga con le colonne dei conti di parte corrente delle istituzioni. La cella all'incrocio della prima riga e della terza colonna rappresenta la domanda di beni finali rivolta ai settori produttivi da ciascuno dei gruppi in cui si considerano distinte le famiglie. I due blocchi successivi, se non sono previste disaggregazioni ulteriori, si configurano entrambi come vettori e rappresentano il consumo finale rispettivamente delle imprese e del settore pubblico.

La sesta cella della prima riga esprime la domanda totale di beni di investimento rivolta ai settori e che viene finanziata con i risparmi accumulati nei periodi precedenti. Se si considera un unico conto capitale comune a tutte le istituzioni, questa cella assume la forma di un vettore. Infine la settima cella indica la domanda di esportazioni sia di beni di consumo che di investimenti.

La seconda riga, intestata ai fattori di produzione, corrisponde al processo di formazione del valore aggiunto. La cella più significativa è quella all'incrocio con la colonna relativa alle attività produttive. La matrice in essa rappresentata mostra come il valore aggiunto formatosi nei singoli settori viene ripartito fra i fattori produttivi considerati. A seconda del criterio con cui sono disaggregati i fattori, essa coglierà quindi la formazione di diversi tipi di reddito, quali reddito da lavoro dipendente, da capitale, rendite, ecc. La cella all'incrocio con la colonna intestata al Resto del mondo, è rappresentata dal vettore del valore aggiunto trasferito all'estero sotto forma di rimesse degli immigrati.

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[1] Questa possibilità corrisponde al principio del *multiple actoring* and *multiple sectoring* richiamato dal SNA93 (cfr. System of National Account 1993 § 20.13, pag 578.)

Ovviamente tutte le transazioni registrate in questa riga non corrispondono a flussi effettivi, in quanto l'introduzione di una riga intestata ai fattori produttivi è solo un artificio che permette di definire la distribuzione fattoriale del reddito, così come, l'introduzione della corrispondente colonna ha essenzialmente la funzione di consentire il passaggio dalla distribuzione fattoriale a quella settoriale senza dover associare in modo univoco ad un dato tipo di reddito un singolo conto (ad esempio il reddito da capitale e impresa non dovrà essere attribuito globalmente al conto intestato alle imprese, ma una parte potrà affluire anche al conto delle famiglie o dalla PA.

La terza riga registra la formazione del reddito disponibile per il settore delle famiglie. La distribuzione primaria è individuata dalla matrice all'incrocio con la seconda colonna, essa indica il modo secondo cui il valore aggiunto percepito dai fattori viene ridistribuito ai gruppi di famiglie. Per pervenire alla definizione del reddito disponibile, accanto alla distribuzione primaria dovranno essere considerati i trasferimenti che avvengono tra le istituzioni e con il resto del mondo. In dettaglio, questi trasferimenti sono rappresentati, nell'ordine, dalla matrice delle transazioni all'interno del settore famiglie e da tre vettori che indicano rispettivamente i trasferimenti dalle imprese, sotto forma di dividendi, i trasferimenti dalla PA e le rimesse degli emigrati ai singoli gruppi di famiglie.

In modo analoga, la quarta e la quinta riga mostrano il processo di formazione del reddito disponibile delle imprese e del settore pubblico che nello schema non risultano ulteriormente suddivisi. Con riferimento al conto delle imprese, la cella all'incrocio con la seconda colonna è il vettore dei redditi distribuiti dai fattori alle imprese (essenzialmente redditi da capitale e ammortamenti). La cella successiva è il vettore dei trasferimenti dai gruppi di famiglie alle imprese, mentre le celle seguenti sono rappresentate da scalari che indicano, nell'ordine, i trasferimenti all'interno del conto, le sovvenzioni ricevute dalla PA e i trasferimenti dall'estero.

Il settore pubblico (quinta riga) riceve reddito dai fattori, sotto forma di redditi da capitale e ammortamenti, rappresentato dal vettore situato nella seconda cella. Alla determinazione del suo reddito complessivo concorrono poi i trasferimenti effettuati dai diversi gruppi familiari e dalle imprese. Tali trasferimenti sono costituiti, essenzialmente, dal pagamento delle imposte sul reddito e sul consumo. Si incontrano poi i trasferimenti che avvengono all'interno del settore, le imposte sul patrimonio, registrate in corrispondenza del conto dei flussi di capitale e, infine, i trasferimenti dal resto del mondo.

La sesta riga riguarda la formazione del capitale ed il suo totale indica l'ammontare di capitale globale disponibile nel sistema. I blocchi più significativi si trovano all'incrocio con le colonne delle spese correnti delle istituzioni. In particolare, in corrispondenza della colonna intestate alle famiglie, troviamo il vettore del risparmio formatosi in ognuno dei gruppi familiari; in corrispondenza della colonna intestata alle imprese lo scalare che esprime i profitti non distribuiti; mentre l'incrocio con la colonna dei flussi di parte corrente del settore pubblico è costituito da uno scalare che indica il risparmio della PA. La settima cella di questa riga, all'incrocio con la colonna resto del mondo, è costituita dal capitale netto ricevuto dall'estero.

La settima riga è intestata al settore Resto del mondo. La prima cella è costituita dal vettore delle importazioni di materie prime effettuate da ciascun settore produttivo; la seconda dal vettore degli eventuali redditi che, percepiti da fattori esteri operanti all'interno del paese, vengono poi ridistribuiti a istituzioni straniere. Le celle seguenti, individuate dall'incrocio con le colonne intestate alle istituzioni, registrano i trasferimenti all'estero delle istituzioni nazionali, costituite da importazioni di beni di consumo o di investimento, profitti distribuiti ad operatori stranieri, imposte sulle importazioni, sovvenzioni a paesi stranieri, ecc. Il totale di questa riga indica le importazioni totali, comprensive non solo delle importazioni di beni intermedi o finali ma anche delle importazioni di servizi, come quelli forniti dai fattori produttivi.

La sintetica descrizione dei flussi rappresentati dalla SAM non solo indica come essa, mediante il passaggio dai conti per branca ai conti per settore istituzionale, trasformi l'impostazione della tavola I-O, intorno alla quale è costruita, ma evidenzia anche che essa è in grado di fornire, rispetto alla Contabilità Nazionale e alla tavola delle transazioni, ulteriori dettagli circa il funzionamento del sistema economico.

Infatti, se fissiamo l'attenzione sul settore istituzione Famiglie, vediamo come la SAM, fornendo un quadro della distribuzione fattoriale del reddito, consenta di cogliere in primo luogo come il valore aggiunto ottenuto dal processo produttivo viene distribuito ai singoli fattori sotto forma dei diversi tipi di remunerazione (salari per i diversi tipi di lavoro, rendite per la remunerazione della terra o di altre risorse naturali, profitti al capitale) e, in secondo luogo il passaggio dalla distribuzione fattoriale alla distribuzione del reddito tra le istituzioni, ed in particolare tra i diversi gruppi di famiglie. La diversa proprietà dei fattori e la distribuzione della ricchezza (che comprende anche le doti e le capacità personali) sono infatti alla base del passaggio dalla distribuzione fattoriale a quella familiare cosicché è possibile modificare la distribuzione personale del reddito sia modificando la distribuzione fattoriale, cioè intervenendo sulla tecnologia impiegata nel processo produttivo, sia modificando la distribuzione della ricchezza in termini di proprietà dei fattori, sia, modificando il modello di trasferimenti governativi.

Le famiglie utilizzano il loro reddito disponibile innanzitutto per finanziare i consumi e l'insieme di transazioni che ne deriva coinvolge le famiglie e i produttori sul mercato dei beni e servizi e mostra la composizione del consumo finale delle famiglie. La domanda di beni di consumo di ogni gruppo di famiglie (che presentano comportamenti di consumo diversi per ammontare e composizione) attiverà settori differenti del sistema produttivo. Dal momento che i settori utilizzano varie tecniche di produzione, ad ogni data composizione della domanda finale corrisponderà una diversa distribuzione fattoriale, e quindi personale, del reddito, che retroagirà sulla struttura della domanda per consumo.

Da quanto detto si evince che la SAM può essere impiegata non solo come modello contabile ma anche sia come complesso schema di analisi volto ad integrare le informazioni relative alla produzione ed alla domanda intermedia e finale con quelle relative alla distribuzione del reddito tra ed all'interno dei diversi settori istituzionali (SAM come schema di rappresentazione del circuito economico), sia come strumento di pianificazione economica, ovvero come modello atto a simulare e a quantificare gli effetti di politiche alternative sulla distribuzione dei redditi.

4 Verso un sistema integrato di Contabilità sociale e ambientale

All'inizio degli anni '90 anche gli uffici statistici delle Nazioni Unite e della Unione Europea hanno introdotto, con il nuovo "Sistema di Conti Nazionali" (il SNA93 delle Nazioni Unite e la sua versione europea quale il SEC95), le norme per la costruzione di una Matrice di Contabilità Sociale[1]. Il nuovo SNA focalizza, più che in passato, l'attenzione sulle diverse tappe che conducono dalla produzione all'impiego del reddito. La Matrice dei Conti Nazionali (NAM) recepisce questa impostazione traducendo in formato tabellare i conti del SNA, con relative unità intestatarie e classificazioni. La NAM, tuttavia, si differenzia dalla SAM tradizionale in quanto le "transazioni effettuate dalle istituzioni vengono registrate in più di un conto, per distinguere i diversi momenti del processo economico. I flussi originariamente registrati nel conto delle istituzioni vengono pertanto disaggregati ed assegnati a tre conti distinti: il conto dell'attribuzione dei redditi primari, il conto della distribuzione secondaria del reddito e il conto dell'utilizzazione del reddito"[2].

Questa visione di conti disaggregati, integrati tra di loro seguendo il flusso circolare del reddito, riflette, l'impostazione dello SNA93. In esso la SAM, data la sua natura flessibile che può essere modificata sia in relazione alla disponibilità delle informazioni sia in funzione degli obiettivi specifici di analisi, dovrebbe costituire il nucleo di un sistema integrato di conti satellite e, cioè, di un set integrato di tavole contenenti dati di natura economica, sociale, demografica, ambientale, espressi sia in termini fisici che in termini monetari.

5 L’avvio della contabilità ambientale tra SNA e Agenda 21

L’idea di estendere la contabilità nazionale per includervi l’ambiente è intrinsecamente legata, fin dall’origine, al concetto di sviluppo sostenibile. L’elaborazione di un sistema di conti ambientali quale strumento a supporto di decisioni in un’ottica di sostenibilità trae ispirazione in particolare dal Rapporto Brundtland (World Commission on Environment and Development, 1987). Il programma dell’Agenda 21 per integrare ambiente e sviluppo nei processi decisionali (UNDESA-DSD, sito web) include esplicitamente la costruzione di sistemi di contabilità integrata ambientale ed economica[3].

In questo periodo sul versante degli economisti prende vigore l’idea di includere nell’analisi economica l’ambiente naturale quale fattore di produzione scarso (Hueting, 1980). Le forti implicazioni per la statistica che ne derivano e la conseguente necessità di un dialogo tra le due discipline trovano espressione nel 1991 in una conferenza speciale della IARIW, in cui viene discusso l’impianto di un sistema di conti ambientali incentrato sui concetti di capitale naturale e di sviluppo ecologicamente sostenibile (Bartelmus Peter, Carsten Sthamer and Jan van Tongeren, 1991).

La revisione del SNA 1968 è una prima risposta all’Agenda 21: il SNA 1993 (Commission of the EC *et alii*, 1993) include nel capitolo XXI una sezione che accoglie gli elementi fondamentali della riflessione sui conti ambientali seguita alla

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[1] Si veda: United Nations, EUROSTAT, IMF, OECD, World Bank (1993), EUROSTAT (1994). Ed anche: Keuning, de Gijt (1992).

2 Si veda Battellini, Caricchia, Coli (1997), pag.8.

[3] Il programma prefigurato nell’Agenda XXI include altre tre aree, rispettivamente le politiche, gli interventi normativi e gli strumenti economici. Dopo la Conferenza di Rio, l’impegno ad implementare l’Agenda XXI è riaffermato nel World Summit on Sustainable Development (WSSD) del 2002 a Johannesburg.

conferenza IARIW del 1991; tale sezione[1] costituisce la base dei contenuti del SEEA 1993, il primo manuale sulla contabilità integrata ambientale ed economica (United Nations, 1993).

In questi anni l'Istat, dopo aver partecipato alla preparazione del primo manuale internazionale sulla spesa ambientale – il SERIEE (Eurostat, 1994) – muove i primi passi verso lo sviluppo di un sistema di contabilità ambientale per l'Italia, avviando nel 1991 un rapporto di collaborazione con la Fondazione ENI Enrico Mattei (Feem) che dà luogo alla costituzione di una apposita commissione di studio (Musu, Siniscalco, 1993)[2]. La Commissione Istat-Feem esamina la letteratura maturata presso gli organismi internazionali, nonché alcune esperienze di avanguardia registrate in Francia, Germania e Olanda[3]; nel suo rapporto vengono affrontati temi destinati a restare nel dibattito degli anni a seguire: il "PIL verde"; il trattamento contabile delle spese ambientali; l'ipotesi di conti ambientali orientati alla misura del benessere; il ruolo del sistema contabile nello studio dell'interazione tra economia ed ambiente e quello delle analisi basate su modelli; vengono inoltre delineati l'impostazione concettuale ed un primo programma di azioni per lo sviluppo della contabilità ambientale in Istat (Costantino, 1993a e 1993b).

In linea con le indicazioni della Commissione Istat-Feem, l'Istituto realizza quindi una serie di approfondimenti metodologici i cui risultati sono raccolti nella collana Annali di statistica (Istat, 1996). Le scelte strategiche, concettuali e metodologiche operate dalla Commissione e portate avanti dagli esperti dell'Istat troveranno poi sistematicamente conforto con l'avanzare degli studi e delle esperienze in campo internazionale – incluso il rapporto Stiglitz-Sen-Fitoussi (Stiglitz, Sen, Fitoussi, 2009) – e negli orientamenti che matureranno presso gli organismi internazionali, in particolare nel contesto della statistica ufficiale europea.

6 Dal SEEA alla strategia europea e i disegni di legge italiani sulla contabilità ambientale

Con la diffusione in "interim version" del SEEA 1993 si avvia un periodo fecondo di riflessione metodologica in ambito internazionale, accompagnato da altrettanto importanti sviluppi sul versante dei decisori politici. Gli avanzamenti conseguiti in particolare nel contesto europeo cominciano a delineare un percorso sempre più definito e di avanguardia. In Italia si afferma anche un dibattito politico specifico, senza precedenti in ambito internazionale, che potrebbe essere decisivo per lo sviluppo dei conti ambientali nella statistica ufficiale e che però rimane senza esito non potendo mai le iniziative potenzialmente più incisive giungere in porto per mancanza di stabilità politica.

[1] Capitolo "XXI. Satellite analysis and accounts" sezione "D, Satellite system for integrated environmental and economic accounting".

[2] Ne fanno parte, oltre agli esperti di Istat e Feem, esponenti del Ministero dell'ambiente, dell'ENEA, della SIS e della Società Italiana degli Economisti.

[3] Particolare attenzione è dedicata al lavoro svolto dalla Commissione interministeriale dei conti del patrimonio naturale istituita dal Governo francese (INSEE, 1986).

6.1 Sviluppi in ambito internazionale

In concomitanza con la pubblicazione del SEEA 1993, in ambito UN-ECE la Task Force on Environmental Accounting della Conference of European Statisticians sviluppa tra il 1992 e il 1994 una riflessione sulla contabilità ambientale in unità fisiche, affrontando due tematiche specifiche: uso e copertura del suolo e impatto ambientale delle sostanze nutrienti (Conference of European Statisticians, 1995)[1]. Gli avanzamenti concettuali e metodologici realizzati, destinati a produrre effetti nel tempo, avranno in particolare significative ricadute nel progetto dell’Agenzia europea per l’ambiente (EEA) sulla contabilità degli ecosistemi, avviato quindici anni più tardi.

Parallelamente all’avvio della sperimentazione nei vari continenti del SEEA 1993, inizia con la costituzione del London Group on Environmental Accounting nel 1994 una fase di approfondimento metodologico[2]. Nel 1997 la Commissione statistica dell’ONU affida al London Group il compito di sviluppare avanzamenti metodologici per la revisione del SEEA 1993. L’Istat, sulla scia dell’esperienza realizzata con la Task Force on Environmental Accounting dell’UN-ECE, si unisce al London Group nel 1996 e partecipa ai lavori per la revisione del SEEA, a tal fine contribuendo anche, nel 1999, con un distacco temporaneo del proprio responsabile sulla materia presso l’ufficio statistico delle Nazioni Unite (UNSD). Al compimento della revisione, il SEEA 2003 (United Nations *et alii*, 2003) si presenta un po’ meno come “sistema”, rispetto al SEEA 1993, e un po’ più come “framework” basato sulle migliori pratiche, tra cui particolarmente rilevanti quelle sviluppate in Europa. Una prima applicazione tematica dei concetti del SEEA 2003 dà luogo al manuale dell’ONU-FAO della contabilità integrata ambientale ed economica per la pesca – SEEAF (UN-FAO, 2004).

La stagione iniziata con il SEEA 1993 è segnata da iniziative che rendono sempre più effettivo ed esplicito il legame tra l’offerta di informazione statistica sull’ambiente – tra cui i conti ambientali – e le esigenze conoscitive legate ai temi della sostenibilità. Significativo, in relazione all’obiettivo di estendere la contabilità nazionale agli aspetti sociali ed ambientali integrando i tre pilastri della sostenibilità, è il workshop organizzato dall’OCSE nel 2003 su “Accounting Frameworks to Measure Sustainable Development” (OECD, 2004a); l’Istat vi partecipa con diversi contributi, tra cui uno sulla contabilità ambientale (Costantino et alii, 2004). Presso Eurostat, a seguito dell’adozione della Strategia per lo sviluppo sostenibile dell’Ue (Commissione delle Comunità Europee, 2001) viene costituita, con la partecipazione di rappresentanti di ministeri ed agenzie per l’ambiente oltre che degli istituti Nazionali di Statistica (INS), una task force sugli indicatori di sviluppo sostenibile (TFSDI); l’Istat vi partecipa attivamente, proponendo l’adozione di alcuni indicatori di contabilità ambientale. Nel 2006 la rinnovata strategia per lo sviluppo sostenibile dell’Ue (Consiglio dell’Ue, 2006), nel sottolineare l’importanza di una “migliore comprensione delle interconnessioni fra le tre dimensioni dello sviluppo sostenibile”, prefigura tra l’altro un’estensione del quadro centrale della contabilità nazionale “mediante conti satellite”, ad esempio sulle spese ambientali e sui flussi materiali. Tra il 2005 e il 2008 il Joint UNECE/Eurostat/OECD Working Group on Statistics on Sustainable Development

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[1] L’Istat guida uno dei due gruppi pilota in cui la task force si articola.

[2] Il gruppo, formato su base volontaria, include esperti degli Istituti nazionali di statistica (INS), ma non solo, e rappresentanti di Eurostat e dell’OCSE oltre che dell’ufficio di statistica delle Nazioni Unite (UNSD).

(UN-ECE, 2009) avvia una discussione sul “capital approach”, un tema in cui ben si colloca la contabilità ambientale, centrata com’è sul concetto di capitale naturale[1].

In ambito OCSE viene sviluppato un programma ad hoc per dar seguito alla Raccomandazione adottata nel 2004 dal Consiglio su Flussi di materiali e produttività delle risorse (OECD 2004b). In particolare vengono realizzati una serie di workshop tra il 2004 e il 2007 ed una guida in tre volumi sulla misura e l’analisi dei flussi di materia (OECD, 2008a,b,c,d), con una parte dedicata ad un sistema contabile specifico, i conti dei flussi di materia a livello di sistema economico (MFA); l’Istat contribuisce con un workshop a Roma nel 2006 e con un distacco di un proprio esperto presso l’OCSE tra il 2006 e il 2007. Viene inoltre avviato, prendendo le mosse dal World Forum di Palermo del 2004 (OECD, 2004c), il progetto globale “Measuring the Progress of Societies”, che perviene nel 2007 alla Dichiarazione di Istanbul (OECD, 2004d). Questa, nell’affermare l’impegno verso misure del progresso delle società che coprano tutte le dimensioni rilevanti, anticipa di fatto l’avvio del processo “GDP and beyond” che si andrà affermando negli anni successivi in ambito Ue.

Il percorso del SEEA ha un nuovo e decisivo impulso con la costituzione nel 2005 dell’UNCEEA, il comitato di esperti di alto livello delle Nazioni Unite per la contabilità integrata ambientale ed economica (United Nations, sito web)[2]. Il comitato ha la funzione di assicurare strategia, coordinamento, priorità e orientamenti in materia di conti ambientali e statistiche correlate; i suoi obiettivi fondamentali sono stabilizzare nel sistema statistico internazionale la contabilità ambientale e le statistiche ad essa connesse, elevare il SEEA a standard internazionale e dare impulso alla sua implementazione. L’adozione dello standard internazionale è prevista per il 2012, al compimento di un processo di revisione cui si è deciso nel 2006 di sottoporre il SEEA 2003 (de Haan Mark, Edens Bram, 2010). A tal fine, sono passaggi cruciali l’individuazione puntuale delle questioni da affrontare, il loro approfondimento e la ricerca di un consenso sulle soluzioni; in tutto questo, un ruolo importante è svolto dal London Group sotto la supervisione dell’UNCEEA. Parallelamente alla revisione del SEEA, il comitato lavora al fine di armonizzare con i concetti, definizioni e classificazioni della contabilità integrata ambientale ed economica le statistiche ad essa connesse, in particolare quelle ambientali. Inoltre, l’UNCEEA sovraintende alla realizzazione di ulteriori applicazioni tematiche dei concetti del SEEA: SSEAW per le risorse idriche (UNSD, 2007), SEEAE per l’energia e SEEA-MFA per i flussi di materia a livello di sistema economico. Con la diffusione del rapporto Stern (Stern, 2007), e a seguito della conferenza internazionale “Climate Change and Official Statistics”[3], l’UNCEEA focalizza la propria attenzione sull’emergenza del cambiamento climatico e sulla risposta che il sistema statistico internazionale deve dare alla domanda di informazione statistica su questo tema.

6.2 Il contesto statistico europeo

[1] Il dibattito verrà ripreso successivamente nella Joint UNECE/Eurostat/OECD Task Force on Measuring Sustainable Development.

[2] L’Istat è tra gli INS che ne fanno parte.

[3] La conferenza è organizzata dallo UNSD in collaborazione con Eurostat, Banca mondiale e Statistics Norway (UNSD, 2008).

Per quanto concerne Eurostat, dopo che sul finire degli anni ottanta l’attenzione alla contabilità ambientale era stata concentrata sulla spesa ambientale – anche per la tradizionale centralità del tema della competitività nel mercato comunitario – con il SEEA 1993 l’interesse si allarga all’intero spettro dei conti prefigurati nel manuale e alle problematiche in esso trattate. La prima preoccupazione è dare una risposta alla questione se gli INS debbano impegnarsi nella costruzione del “PIL verde”; inoltre Eurostat punta ad individuare i conti ambientali più rilevanti nel contesto europeo, da sviluppare prioritariamente.

La Commissione delle Comunità Europee definisce nella sua comunicazione al Consiglio e al Parlamento Europeo COM(94) 670 una strategia per integrare l’informazione statistica su economia e ambiente (Commissione delle Comunità Europee, 1994). L’orientamento di fondo è concentrare il lavoro nel medio termine su pressioni ambientali e risposte del sistema economico – in particolare attraverso strumenti come la NAMEA (Eurostat, 2009a) e il SERIEE (Eurostat, 1994) – collocando in un orizzonte temporale di più ampio respiro i lavori tesi a migliorare le conoscenze metodologiche per la valutazione del danno ambientale; ciò che si prefigura è un sistema di contabilità ambientale di tipo satellite e non un calcolo del “PIL verde”. Per dar seguito a questa impostazione, il primo passo di Eurostat consiste nel delineare, tra il 1994 e il ‘95, un piano di azione su cui attivare i contabili nazionali dei paesi membri; a tal fine viene costituita una task force ristretta che include l’Istat. Dopo che per anni il dibattito si è sviluppato in buona parte tra economisti ed esperti di statistiche ambientali, scende dunque in campo la contabilità nazionale e si apre un periodo che vedrà i paesi membri dell’Ue ed Eurostat all’avanguardia.

A seguito della comunicazione COM(94) 670, si mobilita il sostegno finanziario della DG Environment, favorendo la stipula di numerosi “grant agreement” tra Eurostat e INS, che danno luogo all’avvio sistematico della costruzione di conti ambientali nei paesi membri attraverso progetti pilota. L’Istat, attivo in tutti i gruppi di lavoro e task force di Eurostat, si aggiudica finanziamenti in diverse tornate, arrivando in un caso ad ottenere quasi due terzi dei “grant agreement” offerti da Eurostat agli INS. A ciò si aggiungono anche finanziamenti accordati all’Istituto dal Ministero dell’ambiente. L’Istat realizza così una serie di progetti pilota che fanno dell’Istituto un’avanguardia metodologica nel contesto europeo[1].

In prossimità dell’adozione del SEEA 2003 Eurostat, dopo aver maturato una consistente esperienza in sinergia con gli INS dei paesi membri attraverso gruppi di lavoro e progetti pilota, avvia una riflessione strategica sull’implementazione del manuale internazionale nel contesto europeo. Una task force di alto livello, di cui l’Istat fa parte, lavora alla definizione della prima Strategia europea per la contabilità ambientale (ESEA); quale specifico contributo alla definizione della strategia, nel 2001 l’Istat realizza congiuntamente con il Ministero dell’Ambiente e della Tutela del Territorio una Tavola rotonda sulla domanda di contabilità ambientale in Italia. L’ESEA, adottata nel novembre 2003, è focalizzata sui bisogni degli utilizzatori e su conti ambientali relativi a tematiche prioritarie idonei a soddisfare tali bisogni attraverso un uso efficiente dei dati di base esistenti (Eurostat, 2003a).

Seguendo le priorità dell’ESEA, Eurostat sviluppa insieme agli INS metodologie operative che consentono di passare dalle linee guida del SEEA 2003 alla loro implementazione. Viene messa a punto una manualistica articolata su varie tematiche,

[1] I principali risultati sono testimoniati nella collana Annali di statistica (Istat, 1999; 2003 e 2009).

dalle imposte ambientali ai flussi di materia, dalla spesa ambientale alle foreste, dalle risorse del sottosuolo alle eco-industrie (Eurostat, 2001a,b; 2002a,b,c; 2003b; 2005; 2007); inoltre, grazie al progressivo avvio della raccolta di dati di contabilità ambientale presso i paesi membri – in particolare su spese ambientali, foreste, emissioni atmosferiche, imposte ambientali e flussi di materia – l'ufficio di statistica dell'Ue realizza le prime pubblicazioni di dati riferiti all'Europa.

La crescita della contabilità ambientale nel Sistema statistico europeo (ESS) trova un nuovo supporto con la costituzione nel 2005 del DIMESA, il gruppo di lavoro di Eurostat che raccoglie i direttori nazionali cui fanno capo statistiche e conti ambientali[1]. All'indomani della Conferenza "Beyond GDP" del 2007[2] sono maturi i tempi per una revisione dell'ESEA, essendo stati definiti i metodi per la compilazione di diverse tavole standard ed accumulati i risultati di numerosi progetti pilota condotti dai paesi membri; viene così adottata l'ESEA 2008 (Eurostat, 2008), messa a punto da una task force ristretta di cui l'Istat di nuovo fa parte. I principali obiettivi della nuova strategia sono dare priorità alla produzione su base regolare di un nucleo fondamentale di conti ambientali a scala europea e il mantenimento e l'espansione della contabilità ambientale presso gli INS assicurando armonizzazione, tempestività e buona qualità dei dati. Priorità viene data ai conti relativi ai flussi, prevedendo in primo luogo la costruzione di MFA, conti NAMEA delle emissioni atmosferiche e conti della spesa per la protezione dell'ambiente secondo il SERIEE. Nel medio termine sono previsti conti di tipo NAMEA per l'energia e per i rifiuti e l'estensione dell'informazione economica sull'ambiente a tasse e sussidi ambientali disaggregati per attività economica; rientrano invece in un'ottica di lungo periodo tematiche come le eco-industrie, la spesa per l'uso e la gestione delle risorse naturali, conti di tipo NAMEA per l'acqua e MFA disaggregati per attività economica. Sono elementi essenziali della strategia il sostegno alla revisione del SEEA 2003 e la cooperazione con l'EEA in materia di contabilità degli ecosistemi e dell'uso del suolo e il supporto alla stessa agenzia europea nell'uso di dati di contabilità ambientale a scopi di analisi e ricerca. È infine considerata un'area importante di lavoro la questione della produttività delle risorse, in sinergia con l'OCSE. Ma il fatto più nuovo è la raccomandazione di stabilire una base legale per la contabilità ambientale per la trasmissione obbligatoria di dati ad Eurostat, presupposto per la mobilitazione delle risorse necessarie a stabilire un sistema per la compilazione dei conti su base regolare.

6.3 Sviluppi specifici in Italia

In Italia, parallelamente agli sviluppi nell'ambito della comunità statistica internazionale, comincia a manifestarsi più forte alla vigilia del nuovo millennio l'interesse dei decisori politici per i conti ambientali. Dopo una stagione di generici riferimenti all'importanza della contabilità ambientale quale strumento necessario per lo sviluppo sostenibile – come ad esempio nel "Piano Nazionale per lo sviluppo

[1] Dal 2009 il mandato del gruppo viene esteso per coprire anche le statistiche regionali e l'informazione spaziale.

[2] La Conferenza è organizzata da Commissione Europea, Parlamento Europeo, Club di Roma, OECD e WWF.

sostenibile in attuazione dell’Agenda 21” del 1993[1] – la “Strategia d’azione ambientale per lo sviluppo sostenibile in Italia” del 2002 riafferma il potenziale dei conti ambientali quale strumento da affiancare a quelli tradizionalmente usati per misurare la ricchezza economica del Paese e, nel porre l’accento su uso sostenibile delle risorse naturali e dematerializzazione, chiama in causa in particolare la contabilità dei flussi di materia. Nel Rapporto sullo stato dell’ambiente comincia a trovare spazio una maggiore informazione proveniente dalla contabilità ambientale; inoltre, il Ministero dell’Ambiente e della Tutela del Territorio sponsorizza la messa a punto da parte dell’Istat di linee guida per riclassificare i rendiconti delle amministrazioni pubbliche al fine di individuare la spesa pubblica per la protezione dell’ambiente (Istat, 2007).

In vista di realizzare una convergenza crescente tra domanda e offerta di informazione statistica, tra il 2004 e il 2009 si sviluppa in più fasi una collaborazione tra l’Istat e il Dipartimento per le politiche di sviluppo e coesione (DPS), diretta ad orientare *ex ante* verso i reali bisogni dei decisori l’offerta di informazione statistica. Attraverso un confronto tecnico tra gli esperti sul versante dell’offerta di conti ambientali e quelli sul versante dei potenziali utilizzatori, tale esperienza fa emergere l’importanza attribuita dai decisori alla realizzazione di conti ambientali anche a livello territoriale, in particolare regionale. Sulla base di considerazioni relative sia alla utilizzabilità e rilevanza dell’informazione per le politiche di sviluppo sia alla fattibilità tecnica e finanziaria della produzione di dati di contabilità ambientale a scala regionale, la priorità più elevata viene attribuita agli aggregati NAMEA e ai dati di spesa ambientale. Alle indicazioni emerse da questa esperienza congiunta Istat-DPS fa seguito la realizzazione da parte dell’Istituto di conti delle emissioni atmosferiche per tutte le regioni italiane e di dati relativi alla spesa ambientale delle amministrazioni regionali.

Ma le iniziative di maggiore spicco sono di natura legislativa ed accompagnano per un lungo periodo lo sviluppo della contabilità ambientale in Istat. Nel 1998 un disegno di legge di iniziativa parlamentare avvia un dibattito politico destinato a durare fino ad oggi, che per un decennio coinvolge organi costituzionali, o a rilevanza costituzionale, quali CNEL, Parlamento e Governo. L’obiettivo è introdurre un sistema di bilancio e contabilità ambientale nella pubblica amministrazione ai vari livelli di governo, basato sull’utilizzo di conti ambientali da produrre nell’ambito del Sistema statistico nazionale. Approvato in Senato, il disegno di legge giunge alla Camera dei Deputati, ma l’iter si interrompe per fine legislatura. La proposta viene poi reiterata nel 2001 e ancora nel 2004, di nuovo senza esito, ma qualche anno dopo il DPEF 2007-2010 considera la possibilità di adottare un sistema di contabilità ambientale nell’ambito del bilancio dello Stato e degli Enti territoriali. Infine il Governo presenta al Parlamento nel 2007 un disegno di legge delega per l’istituzione di un sistema integrato di contabilità ambientale, fondamentalmente simile alle proposte di legge che lo hanno preceduto[2]; l’iniziativa governativa però si esaurisce anch’essa con la fine della legislatura. Successivamente il dibattito continua sul piano della sperimentazione, limitatamente a quanto prefigurato per la scala locale.

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[1] Cfr. Ministero dell’ambiente (sito web).

[2] Cfr. Camera dei Deputati (sito web).

7 Oltre il PIL con il SEEA 2012 e il regolamento europeo sulla contabilità ambientale

Successivamente alle proposte di legge, i segnali dalla sfera politica nazionale esprimono un bisogno di supporto concettuale e metodologico da parte dell'Istat a favore di iniziative basate sull'uso di schemi di contabilità ambientale già sviluppati, più che una domanda di ulteriori sviluppi[1].

Lo sviluppo della contabilità ambientale in Istat prosegue su impulso dell'agenda politica internazionale e, più direttamente, in connessione ai programmi dello ESS sui quali tale agenda impatta, piuttosto che in risposta ad una domanda politica interna che di fatto rimane in retroguardia. Dopo la Conferenza "Beyond GDP" e l'adozione dell'ESEA 2008, il contesto internazionale è segnato da ulteriori significativi sviluppi sul versante sia politico sia statistico. Sono punti di riferimento cruciali il rapporto Stiglitz-Sen-Fitoussi, il processo "Non solo PIL", lo standard internazionale SEEA 2012 e il regolamento europeo relativo alla contabilità ambientale.

7.1 L'evoluzione più recente del contesto internazionale

Eurostat prosegue il sostegno agli INS attraverso "grant agreement", sviluppa attività condotte attraverso gruppi di lavoro e task force, arricchisce ulteriormente le proprie linee guida con manuali su eco-industrie e su emissioni atmosferiche (Eurostat, 2009a,b), incrementa la raccolta presso gli INS di dati di contabilità ambientale con questionari su eco-industrie e imposte ambientali per attività economica, oltre che con un questionario relativo a dati regionali. All'azione di Eurostat, tesa allo sviluppo di conti ambientali focalizzati su pressioni ambientali e risposte del sistema economico, si aggiunge l'iniziativa dell'EEA sulla contabilità degli ecosistemi, attraverso la quale si punta a misure più dirette della sostenibilità (EEA, 2010); in tale contesto l'Istat contribuisce alla definizione della CICES, una proposta di classificazione dei servizi degli ecosistemi.

Un'ulteriore iniziativa di rilievo, nel 2009, è la "Green Growth Declaration" del Consiglio OCSE a livello ministeriale[2] (OECD, 2009), la quale sollecita la definizione della "Green Growth Strategy" (OECD, 2010a) e in connessione ad essa prevede lo sviluppo di strumenti di misurazione e indicatori; a tal fine la contabilità ambientale appare come uno strumento particolarmente utile.

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[1] Nell'ambito di un progetto congiunto avviato da UPI e Istat nel 2008, l'Istituto dà il proprio supporto a beneficio di alcuni enti locali impegnati nella sperimentazione a livello provinciale del disegno di legge delega del 2007; all'apposito gruppo di lavoro si unisce la RGS (UPI, Istat, RGS, 2010). A livello nazionale, la legge sulla riforma della contabilità e finanza pubblica 196/2009 introduce nell'ordinamento statale il bilancio ambientale dello Stato quale allegato al rendiconto generale dello Stato – analogamente a quanto era stato previsto nel disegno di legge del 2007 – e la RGS sollecita ed ottiene dall'Istat un supporto in relazione agli adempimenti previsti, in particolare ai fini della riclassificazione della spesa dei Ministeri secondo il SERIEE.

[2] Consiglio formato dai ministri delle finanze, dell'economia, del commercio, degli affari esteri e dell'ambiente.

Un tratto caratteristico del periodo più recente è una crescente sinergia tra le principali iniziative a livello internazionale, che si va coagulando attorno a tre documenti fondamentali: la comunicazione “Non solo PIL” della Commissione al Consiglio e al Parlamento Europeo (Commissione delle Comunità Europee, 2009), il framework sviluppato dall’OCSE per misurare il progresso delle società (OECD, 2010b) e il rapporto Stiglitz-Sen-Fitoussi[1].

Il rapporto Stiglitz-Sen-Fitoussi, nel 2009, è una nuova pietra miliare per lo ESS. Le raccomandazioni in esso contenute vengono esaminate dal gruppo di lavoro di alto livello ESS Sponsorship, istituito su iniziativa congiunta di Eurostat ed INSEE con l’obiettivo di definire priorità e proporre una strategia entro l’estate 2011; vi sono rappresentati diciassette INS tra cui l’Istat, più OCSE e UN-ECE. Per la valutazione della sostenibilità il rapporto Stiglitz-Sen-Fitoussi raccomanda indicatori che possano essere interpretati come variazioni, in termini quantitativi e qualitativi, degli stock rilevanti, tra cui il capitale naturale. L’aggregazione monetaria si ritiene abbia senso laddove esistono ragionevoli tecniche di valutazione, e questo può valere, secondo il rapporto, anche per alcune risorse naturali, come previsto nel SEEA, essendo però chiaro che ciò che si valuta è in tal caso la componente economica della sostenibilità; per la valutazione della componente ambientale, invece, si raccomanda l’utilizzo di indicatori fisici capaci di segnalare la distanza rispetto a livelli pericolosi di danno ambientale, e a tal riguardo si considerano cruciali soprattutto i moduli del SEEA sui flussi di materia ed energia e sugli stock di capitale naturale. Il tema Sostenibilità e ambiente, uno dei tre pilastri del rapporto Stiglitz-Sen-Fitoussi, viene affrontato nell’ambito dello ESS Sponsorship da una apposita task force, alla quale è affidato un approfondimento su come integrare la contabilità nazionale con conti satellite dell’ambiente.

Le raccomandazioni contenute nel rapporto Stiglitz-Sen-Fitoussi costituiscono, tra l’altro, un autorevole sostegno al modo in cui fin dall’inizio è stato orientato il lavoro in Istat, in particolare attraverso la Commissione di studio istituita nel 1991.

Mentre una caratteristica spiccata del rapporto Stiglitz-Sen-Fitoussi è la sua forte base teorica e mentre il framework dell’OCSE ha una valenza specifica data dal suo collegamento al progetto globale “Measuring the Progress of Societies”[2], nel processo avviato con la comunicazione “Non solo PIL” ha un peso particolarmente importante la misurabilità dei fenomeni. Ed è questo il processo che impatta in maniera più immediata sui programmi di sviluppo di Eurostat e degli INS in materia di contabilità ambientale.

7.2 Dentro il processo “Non solo PIL”

Una delle cinque azioni previste nella comunicazione della Commissione Europea consiste nell’estendere la contabilità nazionale alle questioni ambientali e sociali,

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[1] Tra l’altro, una delle conclusioni dei Direttori Generali degli INS nel “Sofia Memorandum” del 2010 sottolinea come misurare il progresso, il benessere e lo sviluppo sostenibile – elementi centrali nei tre documenti – sia una questione cruciale per la statistica ufficiale (ESSC-DGINS, 2010).

[2] Ai fini dell’individuazione degli indicatori da produrre nell’ambito della statistica ufficiale, il dialogo con la società civile assume quindi particolare enfasi.

aumentando l'impiego degli attuali indicatori sociali provenienti dai conti nazionali e stabilendo un sistema di contabilità integrata ambientale ed economica.

Per quanto riguarda la contabilità ambientale, si tratta di integrare i conti nazionali con conti satellite dell'ambiente, da completare a più lungo termine – man mano che verranno concordati i metodi e i dati saranno resi disponibili – con ulteriori conti relativi ad aspetti sociali.

Per quanto concerne i conti ambientali più diffusi – emissioni atmosferiche, flussi di materia, spesa e imposte ambientali – si tratta in prima battuta di estendere all'intera Ue la raccolta di dati presso i paesi membri da parte di Eurostat; a seguire, occorre elaborare conti in unità fisiche per energia e rifiuti e conti monetari per i sussidi ambientali. Occorre inoltre una base legale che renda obbligatoria l'elaborazione di tutti questi conti.

Per quanto riguarda i conti relativi agli stock del capitale naturale, l'impegno europeo continua nel contesto del lavoro intrapreso dalle Nazioni Unite con la revisione del SEEA. In relazione, infine, alla necessità di dati monetari sulla valutazione del danno ambientale provocato ed evitato e sulle variazioni degli stock di capitale naturale e dei beni e servizi forniti dagli ecosistemi, la strategia è quella di intensificare i lavori sulla valutazione monetaria e sull'ulteriore sviluppo di schemi concettuali.

Un sostegno all'approccio "Non solo PIL" viene anche dalla Strategia Europa 2020 (Commissione Europea, 2010), che indica fra le tre priorità dell'Ue "un'economia più efficiente sotto il profilo delle risorse, più verde e più competitiva"; a tale obiettivo è dedicata una specifica "iniziativa faro", mirata a favorire la transizione verso un'economia efficiente sotto il profilo delle risorse e a basse emissioni di carbonio, nella convinzione che occorre scindere la crescita economica dall'uso delle risorse e dell'energia e ridurre le emissioni di CO_2.

7.3 Il SEEA 2012

Essendo la contabilità integrata ambientale ed economica uno strumento fondamentale dell'approccio "Non solo PIL", è cruciale disporre di uno standard internazionale, con raccomandazioni in termini di concetti, definizioni, classificazioni, regole contabili e tavole, allo scopo di assicurare comparabilità internazionale ai conti ambientali e alle statistiche ad essi connesse.

L'adozione di tale standard, il SEEA 2012, è l'ultimo atto di un percorso basato sulla revisione del SEEA 2003, la quale è stata impostata distinguendo chiaramente le questioni che sono sufficientemente mature perché su di esse possa essere raggiunto un consenso e altre che sono più controverse[1]. Il processo di revisione si conclude con una consultazione globale sulle soluzioni adottate e sull'intero testo del manuale, aperta anche ai non addetti ai lavori.

Il SEEA 2012 offre strumenti per una misura congiunta delle performance ambientali ed economiche, ma come il SNA non segue una particolare scuola di pensiero, essendo concepito per poter servire molteplici scopi. La struttura modulare che lo caratterizza consente – non essendovi una stretta sequenza di conti in cascata –

[1] Questioni meno mature, ad esempio le interrelazioni con gli aspetti sociali, sono oggetto di studio a più lungo termine.

la compilazione di alcuni conti senza necessariamente compilarne degli altri, favorendone in tal modo l'implementazione in contesti nazionali diversi.

In relazione al livello di consenso raggiunto sulle varie questioni metodologiche, due distinte pubblicazioni fanno parte del SEEA 2012: il volume 1, che include i moduli per i quali vi è consenso sulle soluzioni adottate e che costituisce lo standard, e il volume 2, dedicato a tematiche controverse o non sufficientemente esplorate ma presenti nell'agenda politica. A questi si aggiunge il volume 3, dedicato alle applicazioni relative ai vari conti inclusi nei primi due volumi. Con le revisioni che seguiranno in futuro è possibile che moduli inizialmente inclusi nel volume 2 diventino maturi per passare nel volume 1[1].

Il volume 1, la parte del SEEA 2012 che costituisce lo standard internazionale, include quattro categorie di conti. Un primo blocco riguarda i conti dei flussi in unità fisiche, per la misura dei fenomeni di utilizzo dell'ambiente naturale quale fonte di risorse naturali e deposito di residui; è fatto specifico riferimento ai vari tipi di flussi – ad esempio di materia, di energia, di emissioni in aria – e vengono utilizzati concetti e classificazioni coerenti con il quadro centrale del SNA[2]. Un secondo blocco di conti è dedicato alle attività e transazioni del SNA connesse con finalità di tutela dell'ambiente naturale, per una loro rappresentazione più esplicita e dettagliata; sono considerati fenomeni come la spesa ambientale, le eco-industrie, le spese e le imposte e sussidi ambientali e l'utilizzo di strumenti per l'accesso alle funzioni dell'ambiente naturale quali ad esempio i permessi di emissione. In un terzo blocco i principi generali del sistema contabile vengono applicati a conti di tipo patrimoniale in unità fisiche e monetarie, con riferimento a distinte componenti del capitale naturale che sostanzialmente corrispondono agli stock considerati nel SNA 2008 (United Nations *et alii*, 2009): le principali categorie sono i terreni, le risorse minerarie ed energetiche, le risorse biologiche (incluse quelle coltivate) e le risorse idriche. Infine vengono illustrati alcuni aggiustamenti che si possono apportare ai principali aggregati monetari del SNA per tener conto dell'impatto dell'economia sull'ambiente, ad esempio monetizzando il depauperamento delle risorse del sottosuolo.

Il volume 2 presenta la parte non standardizzata della contabilità ambientale. In esso vengono affrontate le tematiche della contabilità degli ecosistemi, mettendo al centro dell'analisi lo stato dell'ambiente – non solo le pressioni e le risposte del sistema economico – e i servizi offerti dagli ecosistemi. Inoltre vengono trattate specificamente tecniche di valutazione monetaria per misurare in un contesto di contabilità nazionale i benefici che il sistema economico trae dall'ambiente naturale e i danni che ad esso arreca; in particolare viene affrontata la questione della valutazione monetaria del degrado qualitativo del sistema naturale, dovuto ad esempio all'inquinamento atmosferico[3].

Nel volume 3 il sistema dei conti viene raccordato, attraverso le applicazioni in esso discusse, ad alcune fondamentali tematiche dell'agenda politica, quali il

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[1] L'adozione del volume 1 è attesa per il 2012, quella del volume 2 per il 2013; la diffusione del volume 3 è associata in parte all'una e in parte all'altra delle due pubblicazioni, secondo la corrispondenza a ciascuna di esse delle varie applicazioni in esso descritte.

[2] Una perfetta corrispondenza tra questi conti e i conti economici, in special modo le tavole supply-use, consente di misurare anche, partendo da essi e utilizzando modelli input-output, ad esempio l'ammontare di emissioni atmosferiche che determinati consumi globalmente implicano.

[3] La valutazione monetaria del depauperamento quantitativo di risorse naturali che sono oggetto di transazioni sul mercato è trattata nel volume 1.

cambiamento climatico, la produttività delle risorse e la sostenibilità dello sviluppo; vengono così messi in luce alcuni modi in cui l'informazione statistica fornita con i conti ambientali può supportare il dibattito, sia direttamente sia attraverso l'uso di modelli.

Alcuni scostamenti rispetto al SNA 2008, dovuti ad importanti differenze concettuali, caratterizzano il SEEA 2012. Sul versante della valutazione monetaria, ad esempio, i benefici non vengono intesi in senso economico stretto. Inoltre, i benefici che derivano dal capitale naturale vengono riconosciuti come tali anche se derivano da componenti di tale capitale non soggette a diritti di proprietà; in effetti, il capitale naturale secondo il SEEA 2012 è più ampio di quello rappresentato entro i confini del SNA 2008[1]. Per quanto concerne alcuni trattamenti contabili, particolarmente rilevante è il fatto che il depauperamento delle risorse naturali non rinnovabili – che si sostanzia in un consumo di capitale naturale – viene trattato nel SEEA 2012 in modo simile agli ammortamenti del capitale prodotto, con conseguenze non solo nei conti patrimoniali ma anche negli aggiustamenti agli aggregati del reddito e del risparmio descritti nel volume 1. In altri casi, pure relativi a fenomeni di rilevanza ambientale quali ad esempio i permessi di emissione, vengono seguiti i criteri del SNA 2008.

7.4 Il Regolamento del Parlamento Europeo e del Consiglio sui conti economici ambientali europei

Mentre la revisione del SEEA 2003 è prossima al suo compimento e quindi si avvicina l'adozione del SEEA 2012 come standard internazionale, il Parlamento Europeo ed il Consiglio sono pronti ad adottare un regolamento relativo ai "conti economici ambientali europei", già perfezionato nella versione originale inglese e solo da tradurre nelle altre lingue. L'obiettivo del regolamento è triplice: attuare le indicazioni contenute nella sezione dedicata ai conti ambientali nel nuovo capitolo sui conti satellite del prossimo SEC riveduto; dare priorità alla produzione su base regolare di una serie fondamentale di conti secondo la strategia ESEA 2008; creare le condizioni affinché nell'Ue continui presso gli INS lo sviluppo della contabilità ambientale e si possa disporre di dati armonizzati, tempestivi e di buona qualità. Il regolamento dovrebbe tra l'altro, nelle intenzioni del legislatore, indurre a mobilitare le risorse che i paesi membri devono mettere a disposizione degli INS se vogliono assicurare la disponibilità di una informazione statistica in linea con l'ESEA 2008.

In considerazione del fatto che i vari moduli della contabilità ambientale hanno raggiunto nell'Ue stadi di maturità differenti, la strategia del legislatore è quella di procedere con successivi atti legislativi, includendo in questo primo regolamento un pacchetto di conti cui nel tempo seguiranno altri.

Anche se le esigenze conoscitive possono variare da paese a paese in funzione della tipologia di ambiente naturale che caratterizza ciascuno di essi o delle specifiche priorità nazionali, vi sono conti che appaiono fondamentali per la generalità dei paesi dell'Ue, come quelli concernenti i flussi di materia, le emissioni atmosferiche, l'energia, le risorse naturali, le spese e le imposte ambientali. Tra queste tipologie di conti, tre

[1] Peraltro è chiaro quale è la parte comune ai due sistemi e quale la parte aggiuntiva, trattate rispettivamente nel volume 1 e nel volume 2 del SEEA 2012.

hanno già evidenziato un livello elevato di fattibilità nella maggior parte dei paesi dell'Ue e sono dunque oggetto del regolamento di prossima adozione: questo prevede tre moduli, uno per i "conti delle emissioni atmosferiche", uno per le "imposte ambientali ripartite per attività economica" e uno per i "conti dei flussi di materia a livello di intera economia"[1]. I primi dati dovranno essere trasmessi ad Eurostat nel 2013 ed avranno come anni di riferimento il periodo dal 2008 al 2011.

È prevista anche l'elaborazione di un programma di studi pilota con la finalità di migliorare la trasmissione e la qualità dei dati, di ottimizzare le metodologie e di preparare il terreno per ulteriori sviluppi in vista di costituire una base legale anche per gli altri moduli di contabilità ambientale che man mano matureranno.

In previsione del fatto che potranno nel tempo intervenire sviluppi tecnici, economici e ambientali tali da richiede un adeguamento dei moduli inclusi nel regolamento, è previsto che la Commissione Europea possa adottare a tale scopo atti delegati, secondo una procedura che coinvolgerà in seno ad Eurostat il Comitato del Sistema Statistico Europeo (ESSC)[2].

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[1] Attualmente Eurostat raccoglie i dati derivati da tali conti mediante appositi questionari inviati con cadenza annuale o biennale agli INS, i quali li compilano su base volontaria.

[2] Lo ESSC include i rappresentati degli INS.

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France's redesigned census: lessons and prospects

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Abstract. From 1801 to 1999, France periodically conducted "traditional" censuses with exhaustive enumeration. In 1997, it decided to undertake a radical reform of its census involving (1) a switch to annual surveys in parts of the country, (2) introduction of a sample survey in large municipalities based on a statistical register of addresses, and (3) annual publication of detailed results using five annual surveys and administrative data. This system is now operational and is supplying results on a regular basis. Have the goals of the reform been met? This paper analyzes the successes and difficulties of the project, and assesses the extent to which it has met its goals for cost, data quality, and information timeliness. We describe the defects and risks that emerged during implementation, and discuss planned developments.

1 The new French census system works

In the late 1990s, INSEE decided to launch a thorough reform of the exhaustive-census model that would replace periodic enumerations with an annual sample-survey system (Godinot, 2004 and 2005). The census results are now compiled annually—at all geographic levels from municipal to national—using data from five successive surveys supplemented by administrative sources (see Annex). Seven years after the start of data collection for this new census, the outcome is largely positive.

1.1 The surveys are being conducted in highly satisfactory conditions

The February 2002 Act establishing the new census called for a sharing of census-taking operations between INSEE and French municipalities: INSEE organizes and supervises the surveys, but the municipalities prepare and execute them, notably by

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hiring, managing, and paying the enumerators. In the context of decentralization and occasional tensions between the State and local government over the distribution of resources and responsibilities, it was by no means certain that this partnership would function properly.

In the event, the establishment of annual data-collection procedures went smoothly, thanks to major communication and support actions aimed at the municipalities. Even before the first surveys, INSEE launched a communication program to provide an overall explanation of the new system. Every year, INSEE now assists the municipalities conducting the survey in the quarter preceding the collection, then during the collection itself. INSEE staff train the municipal personnel in charge of the operation, as well as enumerators. Over the years, the municipal personnel acquire an experience that contributes to the operation's efficiency. This professionalization is particularly intensive in large cities—which conduct annual surveys—but is also significant in smaller towns.

At INSEE as well, we have drawn lessons from the initial collections. We have gradually refined the protocols and instructions, made marginal changes in printed collection and management forms, and taken other steps to increase data-collection efficiency and speed.

From this standpoint, we have clearly reached our goal of improving survey quality control. Thanks to regular assessments of the process by all participants, we have achieved progress where needed (see Cézard and Lefebvre, 2009).

Once the new census had been endorsed by municipalities, we needed to enlist the support of the population. "Traditional" periodic censuses can rely on communication campaigns that present the operation as a comprehensive operation limited in time. The partial annual census cannot rely on these arguments. Nevertheless, a communication campaign focused on the usefulness of the census and, secondarily, on the innovative and money-saving aspects of the new system has generated a fairly strong endorsement by the population.

From year to year, we do not observe any deterioration in collection quality. The non-response rate remains very low and is not increasing; the share of municipalities unable to complete the collection on time remains negligible, and the number of collections that INSEE needs to "adjust" via additional surveys remains minimal.

1.2 Legal-population figures are calculated, disseminated, and generally accepted

The second challenge of the new census was the determination of the legal population of France's 36,682 municipalities (*communes*) at end-2008, using the 2004-2008 surveys, the register of localized buildings (Répertoire des Immeubles Localisés: RIL), the register of institutions, and the occupancy-tax (*taxe d'habitation*) data. This task was completed on time.

Throughout 2008, INSEE conducted another communication campaign to inform mayors of the calculation method and announce the future annualization of the figures. In December, each mayor received the figures for his or her municipality a few weeks before the official publication of the list in a decree.[1] INSEE Regional Offices made arrangements to answer mayors' requests for information. More than 1,200 mayors actually asked for explanations in the weeks that followed. After receiving the information, very few municipalities expressed dissatisfaction. The number of formal complaints (in the legal sense) was insignificant and did not concern key aspects of the method.

We repeated the above operation in December 2009 and December 2010. Technically speaking, this entailed no additional difficulty for INSEE, as the method for determining the figures was identical. By contrast, the communication program was complicated by the proximity with the previous year's figures: data freshness—one of the new method's key contributions—creates demanding requirements when annual variations for 36,682 municipalities need to be checked and justified.

Despite the crucial innovation—for mayors—consisting of annualized results and despite the risks of time comparisons, the number of requests for explanations received by INSEE decreased from 500 at end-2009 to 400 at end-2010.

Yet we cannot take the acceptance of the method for granted everywhere. A small number of mid-sized municipalities have challenged the latest figures, sometimes vehemently. Most are municipalities whose 2006 population exceeded that of 1999 and has since been trending down. Even a mild decrease has a symbolic effect on the municipalities concerned, as well as an impact on local finances. INSEE devotes considerable time to checking the data and then explaining the method to these elected officials.

While these isolated complaints call for the greatest vigilance, the decision to prepare annual figures of the official population at all geographic levels has clearly proved to be a winning proposition.

1.3 Detailed data are published every year and have found their audience

Six months after publishing the first population figures based on the new census, INSEE released a broad set of statistical data on its website. Like the population figures, they were based on the 2004-2008 surveys and used 2006 as reference year. The data were fully consistent with "Legal" population figures.

This release was designed to satisfy demand from varied segments of the public. We accordingly organized the data in several complementary forms. For the "general public," the data are directly accessible and retrievable on our website, in a rather user-friendly format and presentation. For specialists and professionals, we provided downloadable databases requiring subsequent handling by the user.

In the first segment, we prepared easy-to-print pages of "key figures" on all municipalities—down to the smallest—with a few charts and data comparisons with earlier censuses. Also for the general public, but only for larger geographic units, we prepared detailed tables combining several variables, often comparable with those of the 1999 census. For specialists, we compiled databases containing the figures of the

[1] See legal populations at Insee - Populations légales 2008.

detailed tables and allowing all possible geographic aggregations. A few months later, we added databases at infra-municipal level and databases of individual anonymized data. For the first time, microdata from a census are available free of charge to a wide public and can be freely tabulated by users.

The overall device was designed after numerous consultations with regular users of the census. Its implementation then mobilized members of the production team of Census and broadcasters.

In summer 2010, we "refreshed" all these data and made them consistent with the official population figures dated 2007.[1] Although only some of the data actually reflect updated information (only one-fifth of the information is truly fresh), INSEE has decided to make all the data available again each year.

Early feedback from users is largely positive: the census statistics have found their target audiences, both in local communities and among analysts and researchers. Users appreciate the quantity and variety of the information, as well as the richness of the documentation. But, as always, this publication generated additional demand that was expressed by website visitors, at meetings with public players, in an *ad hoc* group at the National Council for Statistical Information (Conseil National de l'Information Statistique: CNIS), and in a July 2010 online satisfaction survey.

Like the other arrangements, the dissemination system is not frozen. We made marginal changes in summer 2010 and are reorganizing it for summer 2011, particularly to facilitate navigation on the website.

Today, we can confidently state that the census data are widely disseminated and used by a varied and generally satisfied public.

1.4 The quality of the data produced is not challenged

Publishing detailed census data every year, strictly on time, would not be a success if the quality of the data were not recognized. The radical change in the census method created a moderate risk of decline in quality relative to "traditional" censuses, particularly because of the introduction of sample surveys and the longer time frame for the collection. We had weighed and estimated the risk in the design phases, notably through simulations.

During the "ramp-up" period, i.e., between 2004 and 2008, we conducted studies to verify the plausibility of the provisional data in demographic terms and the credibility of statistical results, in consultation with INSEE specialists in the relevant fields such as employment, education, and housing. Once we were sure of the quality of the national data, we performed validation tests on local data in cooperation with our Regional Office network. Lastly, the main dissemination products underwent multiple rereadings in the months before their online release. These progressive validation phases led to the publication of national and regional results as early as 2005. And they enabled us to verify the quality of the final results as thoroughly as possible.

Since the initial publication, our validation tests are more abbreviated: they concern (1) the legal populations of municipalities, with systematic analyses of major annual trends, and (2) selected statistical results for regions and départements.

[1] See results at Insee - Results du census de la population - 2007 - Accueil.

The response from national and local users of these data over the past two years has convinced us that the quality of the results of the new census is at least as high as that of the figures from older censuses.

The quality of the new census holds, first of all, with the innovations brought by the new formula compared to a traditional census. The availability of an annual directory of buildings in towns with more than 10,000 people ensures that no address has been omitted in data collection operations. The distribution over five years of data collection in municipalities with fewer than 100,000 inhabitants decreases the burden on the statistical institute, and allows a streamlined monitoring of these communes, in favor of a higher quality.

More importantly, the annualisation of the operations of census allows a true control of the process, enabling the funding of improvements over successive years. These check operations and the continuity of the method from one year to another make it possible to reduce to the strict minimum the data-collection risks specific to the traditional censuses. Since the introduction of the rolling census in France, no statistical adjustment was necessary to understand the evolution of populations, contrary to past experience.

However, it would be inaccurate to state that the census results are flawless.

Some defects are trivial and can be explained by failure to collect data (isolated cases) or to edit data (for which we can take remedial action). These defects were already present in earlier censuses, but there was no hope of correcting them in later rounds.

Other defects are more “structural” and require deeper methodological scrutiny.

The first is the apparent underestimation of young children aged 0-4, which becomes visible when we compare the census numbers with vital statistics. This is a known problem in censuses, both in France and elsewhere, but the new method does not solve it.

The census also seems to underestimate the number of people recently arrived in France, by comparison with administrative data on international migrations.

2 Adjustments and improvements are needed

2.1 The annual series raise questions about the quality of the source

The new census produces data every year at all geographic levels. As soon as we introduced the system, we clearly announced that these successive data would not constitute annual series in the usual statistical sense: only results compiled from independent data sets (i.e., at least five years apart) are strictly comparable. Pending publication of the results dated 2011 (i.e., obtained from 2009-2013 surveys), the local data from the census can be compared only with the figures of the last “general” census of 1999.

This scientific “warning” is not always heeded or well understood by users. It generates complaints from some elected officials (in localities where annual figures are trending down) and serves as an argument for persons (now admittedly few in number) who still oppose the change of method.

For INSEE, the analysis of annual trends, at least in large cities, is a means to control the quality of results: any significant change (taking into account the confidence interval of the sampling process) must be explainable either by a duly verified event (concerning the number of dwellings in the municipality or neighborhood) or by a regularly observed trend. Otherwise, the system may very well have malfunctioned. Thus far, we have confined these verifications to the population figures. We need to perform them more systematically in order to prepare the dissemination of data fully comparable at intervals of at least five years.

In the new census system, each annual survey is supposed to be representative at national and regional level. The sample for each annual survey was built to form, at these higher geographic levels, an independent survey comparable from year to year. INSEE has not yet conducted a systematic analysis of the quality of the resulting series; there are a few exceptions, at national level only, for demography and employment. Absent this expert review, the annual census surveys are not playing their initially intended role in official statistics.

2.2 Collection costs are rising every year

As regards census costs, the goal of the redesign was not to reduce the cost of the operation but to smooth it over time. The sampling rate in large municipalities was actually calculated so that the survey volume would be equal to one-seventh of that of an exhaustive survey, in reference to the “usual” seven-year frequency of the last general censuses. INSEE consequently spends some €33 million on the census every year, roughly one-seventh of what an exhaustive survey would probably have cost.

This expenditure, now included in INSEE’s annual budgets, is no longer exposed to the same risk as the former censuses: it should be recalled that France’s last general census was postponed from 1997 to 1999 for budget reasons. Of the annual €33 million, INSEE transfers €22 million to municipalities, which collect the data. The rest is spent on the printing of census forms, the capture of questionnaires by optical scanning, the communication campaign, INSEE staff travel, and the compensation of certain inteviewers.

The financial system is therefore functioning as planned. However, it now faces pressure due to the overall restriction in public spending as well as to population growth.

The INSEE budget, like those of all government agencies, is subject to constant downward pressure, even in nominal euros. For example, in 2011-2013, it must be cut by 10%. As the census alone accounts for over a third of INSEE expenditures, it must be included in the common effort to curb spending.

At the same time, the French population is rising by nearly 0.7% per year. Collection costs—the largest single item of the INSEE budget—are largely proportional to population size. The rules governing the INSEE allocation to municipalities actually stipulate that this funding is strictly proportional to population.

The issue of the medium-term sustainability of census funding is therefore on the table.

Beyond the financial aspects, there are also human-resource issues involved. At INSEE, 450 staffers are assigned full-time to census work: 40 to the design and central management, 260 to the organization and monitoring of operations in Regional Offices, and 150 to sampling-frame maintenance. During the collection period, another 500 staffers are responsible for training, accompanying, and supervising municipal personnel conducting census operations. Our survey experience shows only a very small decrease in this human-resource requirement. However, like all government agencies, the Institute is experiencing a steady, significant decline of its workforce. Again, the issue of sustainability is on the table.

At a lesser level, many municipalities are complaining of their difficulties in hiring sufficient enumerators. This situation is reported by one-half of localities that need to hire more than ten enumerators.

2.3 The data processing workload is not diminishing year after year

The repetitiveness of the construction of census results gave us reason to hope that, once the system was up and running and the first series of detailed results had been published, the workload involved in preparing and validating the data would diminish. Our experience shows that this is hardly the case at the moment, and the situation is unlikely to improve in the years ahead—especially if we want to settle the quality issues that are emerging. The actual methodological work of establishment of the standard calculation method is completed since 2008, and corresponding computer programs as well. But the effective reduction in the properly methodological needs was compensated by an increase in the load of processing data, because of need for permanent adaptations.

A ten-member team is responsible for the specifically "statistical" aspects of the census that range from sampling to determination of legal populations, processing of variables, weightings, validations, and production of microdata files. This workforce is as large as it was in the "project design" period. Why are we not achieving "productivity gains" here? Basically for three reasons:

a) Although we have now stabilized the method, some parameters of the statistical environment are evolving

b) Over a five-year period, some of the statistical ingredients of the census are proving unstable
c) The methodological teams are responsible for correcting the accidental defects in the basic census data.

a) Although we have now stabilized the method, some parameters of the statistical environment are evolving

The census method is based on the five-year stability of the “municipality” entity whose legal population we seek to determine. But every year a small number of municipalities merge or, on the contrary, are created through separations, or adjust their borders through territorial exchanges. The treatment of these modifications varies according to the position of the event date relative to the census collection cycle. Each “event” of this kind therefore requires several years of *ad hoc* calculations.

While municipalities are born and disappear, they also change size, notably by crossing the 10,000-inhabitant threshold upward (approximately twenty a year) or downward (two or three a year). Here as well, therefore, we need to define specific calculation procedures for the municipalities’ entire “transition” period between the old and new calculation methods that concern them.

Lastly, the census questionnaire is not set in stone: in 2011, we modified it for the first time since 2004, in a marginal way, to adapt it to the 2011 EU census regulations. The publication of detailed results based on data collected with different questionnaires is obviously a difficult, costly, and sometimes ultimately impossible statistical challenge.

A further change in the questionnaire is planned for 2014, after a round of discussions starting in spring 2011. This will generate a new methodological workload.

b) *Over a five-year period, some of the statistical ingredients of the census are proving unstable*

The method set up both to estimate populations and to describe them presupposes explicitly or implicitly that the phenomena observed will follow a certain “trend” over the five-year period. In small municipalities, we extrapolate or interpolate by making proportionality hypotheses. In large municipalities, we apply five-year moving averages for the variables to a known number of dwellings in the median year. But, with respect to these trends, some phenomena are “accidents” inadequately addressed by the basic method. The first example is the temporary closing, for renovation, of a institution (retirement home, student residence) for the two months of the collection period—an event that potentially “deprives” the municipality of the institution’s population for several years. The second example is the demolition of a large building preceded by a period in which the dwellings are gradually vacated. If this situation is not properly handled, two risks arise: first, the building may be surveyed at a time when it is almost empty; second, the building may disappear from the address register. Another situation worth mentioning is the change in legal status of a retirement home (institution) that makes it subject to the occupancy tax (*taxe d’habitation*) in a small municipality: the normal extrapolation may cause an increase in the number of “private” dwellings to show up in the figures, whereas the institution has already been included in the total.

c) *The methodological teams are responsible for correcting the accidental defects in the basic census data*

Lastly, an inevitable number of quality accidents occurs in the census—as with all very large-scale statistical operations repeated every year and from which results are expected for more than 36,000 territorial units. Accidents include errors (involuntary omissions and double counts) in the sampling and editing frames (namely, the localized building register and institution register), collection errors (such as forgotten units, and surveys carried out by mistake in large municipalities), deficiencies in the occupancy-tax database (of which INSEE not control the compilation process), and so on. All these errors, when spotted in time and statistically significant, are subject to corrective calculation. Some errors are reported by the municipalities themselves upon receipt of the intermediate data concerning them. However, INSEE takes steps to ensure that municipalities are treated fairly.

A total of some one hundred and fifty municipalities a year are subjected to an *ad hoc* calculation, and at least fifty are reviewed in an in-depth analysis that does not result in an adjustment. These various adjustments and corrections make up approximately one-third of the “data processing” workload for the census.

3 Developments planned for the years ahead

In addition to methodological work on data-quality monitoring, discussed earlier, most of the developments planned for the years ahead seek to cut costs without lessening process quality control—and, if possible, to concurrently improve the process. As the bulk of the census cost is generated by information collection, we shall concentrate our efforts on the latter.

3.1 Introduction of online collection and modernization of address-register management

The 2004 census redesign was undertaken without changing the collection protocol: the census forms are dropped off by the enumerator, filled out by households, retrieved by the enumerator, then scanned for data acquisition.

The first notable change in this protocol will be to introduce online response for households starting with the 2013 survey. This fully voluntary option should enable us to: reduce travel by enumerators; improve the quality of the information collected (better control of filters, multiple-choice answers, and overall consistency); reach and convince certain population segments more easily; improve the public image of the census; and reduce data-capture costs. However, the implementation of the option is neither cost-free nor risk-free, for it must blend smoothly into existing protocols and information systems. It involves informing the enumerator—as promptly as possible—that a household has responded online, so as to save him/her a visit. With the enumerator now working under the municipality’s supervision, we need to rethink the entire information flow between INSEE and municipalities, and adjust it to the wide diversity of situations.

This modernization will offer INSEE an opportunity to launch an overall modernization of the collection-monitoring system with the aim of saving resources and controlling quality. In particular, the system will include a monitoring tool to enable municipalities to determine whether a household has responded online. By the same occasion, INSEE will be able to check collection progress for each enumerator. We shall thus be able to focus our efforts on the sectors that are behind schedule. Experience has taught us that collections that do not start at a fairly brisk pace are typically the ones that ultimately pose data-quality problems.

At the same time, INSEE will upgrade the management of its "register of localized buildings" (Répertoire des Immeubles Localisés: RIL). The RIL, which is maintained only in large municipalities, serves both as a sampling frame for annual surveys and a reference for calculating legal populations. It is extremely costly to maintain, as it occupies 140 staffers in our central and regional offices. The reason is that, because of its very design, it requires heavy local expertise, at INSEE itself and in municipalities, yet even this does not ensure perfect nationwide consistency or stable quality. We shall therefore rethink the updating process and the underlying information-technology infrastructure so as to improve the supervision of operations and of their statistical impact, as well as to reduce management costs.

3.2 Creating a statistical register of dwellings

The second important stage in census modernization will be the implementation of a new infrastructure in the French statistical system: a statistical register of dwellings. This is a "structuring" operation that should satisfy several needs at INSEE: the establishment of a more effective sampling frame for household surveys; creation of a repository of addresses for geolocation operations involving administrative sources; but also improvement of census quality, introduction of direct mailing of census forms, and upgrading of the statistical model for the census.

The register itself should be largely compiled from tax data and be enhanced by systematic mapping through the cadastral survey reference, henceforth linked to a geographic information system (Système d'Information Géographique: SIG). We have conducted initial tests on this source. First, we have checked that the address quality allowed interviewers to unambiguously locate a building. Second, we have verified the quality of statistical information on the number of dwellings and population figures. The results of all these investigations were sufficiently encouraging for INSEE to decide to launch the register-construction project. Work will begin in autumn 2011.

Initially, i.e., around 2014-1015, the register will serve as a tool for improving census quality. In large municipalities, the RIL must be consistent with the dwelling register. Discrepancies will need to be reviewed and resolved. As each source has its own updating procedure, it will serve as "quality benchmark" for the other. In small municipalities, the dwelling register will serve as the initial address base to prepare the collection, avoiding needless captures and involuntary omissions. Conversely, the census surveys will enable us to correct the quality deficiencies of the dwelling register.

These changes will not constitute a “revolution” of the census model: the use of administrative data to check RIL and collection quality, called for in the official guidelines for the redesigned census, has already been put into practice (see Clanché, 2010). Rather, the aim is to systematize the use of administrative data and introduce it at earlier stages of the census processes.

3.3 Gradual introduction of direct mailing

The second stage of the use of the statistical register of dwellings in the census could be the gradual introduction of postal delivery of forms, as already exists in many countries. The system was not possible in France until now, absent a list of dwelling addresses available ahead of the collection. Even in large municipalities, it is the enumerators who, when preparing their rounds, compile the exact list of dwellings to be surveyed.

By using the addresses supplied by tax offices, the dwelling register allows a “targeted” mailing of forms to a very large majority of persons to be enumerated. This change will greatly diminish the survey burden. Naturally, however, the enumerator will still have a substantial amount of work: checking the exhaustiveness of the base (number of dwellings for large municipalities, of addresses for small ones), management of incorrectly addressed envelopes returned to sender, and, of course, retrieving the forms.

As of now, postal delivery is merely a plan that INSEE is considering, without a specific implementation date. Even more than the introduction of online collection, it will modify the roles of participants in the census process, as well as the division of labor between INSEE and municipalities. The project will therefore require a major testing and consultation phase, which has not yet even been scheduled.

3.4 Medium-term evolution of the statistical model

Lastly, the statistical register of dwellings could allow the basic statistical model of the census to move toward a smaller number of surveys. The modernizations described above make it possible to reduce collection costs for a given annual-survey size, i.e., without compromising the exhaustiveness of the five-year collection in small municipalities while preserving an 8% annual sampling rate in large ones.

The statistical register of dwellings does not only include exact dwelling addresses. It also provides information on the dwellings (size, construction date, occupancy status) and their occupants (number, gender, age, income levels). Admittedly, this information does not always match the census definitions exactly, and the occupants may have changed between the source compilation date and the census survey. Nevertheless, it does constitute additional information that may strongly enhance the survey’s sampling and processing efficiency.

If the statistical qualities of the register are confirmed, it could allow an overall reduction in survey volume without undermining the final accuracy of the data published. We might thus be able to increase the sampling rate in large municipalities, introduce sampling in mid-sized municipalities, and increase the intervals between exhaustive surveys in the smallest municipalities. In large municipalities, the possibility of identifying floors in apartment buildings before the survey might also enable us to cease the systematic sampling of entire buildings. This would limit the cluster effects that degrade sampling efficiency.

This change, unlike the previous ones, will not affect the collection protocol, but it will disrupt the methodological balance between "traditional" collection and statistical processing defined by the 2002 Act. It will require adjustments in regulations, and a fresh effort to convince census users. This will only be possible if, in the meantime, the lingering manifestations of reluctance to accept the present method have been overcome.

Conclusion

The new census system introduced in France in 2004 has met its goals. Good-quality results are disseminated annually at all geographic levels. Nevertheless, the census will evolve in the years ahead, chiefly in order to reduce costs without jeopardizing the quality of results. The first phases of this modernization are under development and will be implemented by 2015. Others are still in the preliminary design stage and will probably be launched between 2017 and 2020.

Annex: The French census since 2004

Since 2004, annual surveys have replaced the traditional exhaustive enumeration conducted every seven or nine years. The survey method varies according to the size of the municipality (*commune*).

Municipalities with a population of under 10,000 are enumerated every five years on a rolling basis. They have been divided into five groups, under rules that ensure an equivalent number of inhabitants in each group. Every year, the census survey covers the entire population and all the dwellings of the municipalities in the designated group. Over a five-year cycle, the entire population of municipalities with a population of under 10,000 will have been enumerated.

In municipalities with a population of 10,000+, a sample of inhabitants is enumerated each year. The annual survey covers a sample of addresses representing around 8% of the population. Over a five-year cycle, the entire territory of each municipality is covered and some 40% of the population of these municipalities will have been enumerated.

The collection frequency is therefore five-yearly for municipalities with a population of under 10,000 and annual for municipalities with a population of 10,000+. The census survey is exhaustive for the first group, and sample-based for the second. Concretely, around 9 million people are enumerated every year, or 14% of the population living in France.

The data disseminated annually are based on the five most recent census surveys. They therefore concern 45 million people or 70% of the population. The data collected over the five years are assigned to the same reference year (the median year) using interpolation and extrapolation methods and moving averages.

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Child Labour in Italy: a Review

Giuliana.Coccia and Alessandra Righi

Abstract - This paper first briefly describes legal aspects of child labour, before reviewing the relevant estimates carried out in Italy and their main features. These estimates, which are mainly carried out locally and occasionally, differ by tens of thousands of units. All these elements help trigger an emotional debate on this argument. Some available statistical indicators that enable to study child labour are also considered. Conclusive remarks underline the opportunity to develop some strategies for regular measuring at national level.

1 National legal aspects

International laws and especially the ILO's Conventions have provided a considerable impulse and strong influence on the Italian legislation on child labour. Law no. 977 of 17 October 1967 on the "Protection of Children and Adolescents at Work" laid down a first regulation on child labour in Italy. Then, it was modified and amended by Legislative Decree no. 345 of 4 August 1999, transposing directive 94/33/EC on the protection of young people at work. Based on this law, children under 15 years of age and/or children who have not completed mandatory schooling cannot be employed, nor can they perform a work activity (Camera dei Deputati, 1998).

It is prohibited to employ children in a series of activities, processes and works (attachment I, added to Law no. 977/67 by article 15 of Legislative decree no. 345/99), except for didactical reasons or professional training. A derogation of this law (Law no. 977/67, art. 4, comma 2) permits children to be employed in cultural, artistic, sport or advertisement related activities, previously authorised by the Provincial Labour Offices.

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Following some important new elements introduced by Legislative Decree no. 626 of 19 September 1994 on safety at work and by article 1 of Law no. 9 of 1999, which raises to 9 years the compulsory schooling, it became necessary to modify Legislative Decree no. 345/99. Legislative Decree no. 262 of 18 August 2000 amends the aforementioned Law and aims at protecting the health of children and promoting their school and professional training.

Article 1, comma 622, of Financial Act 2007 (L. nr 296/2006) establishes that "the education given for at least 10 years is compulsory and should allow obtaining an upper secondary school degree or a professional qualification of at least three years before reaching 18 years of age. Consequently, the age to access the labour market rises from 15 to 16 (….)" (Coccia, Righi, 2008).

2 Main estimations in the Italian literature

The research shows that reliable estimations at national level have been carried out only since the 1990s, although using methods that are not consistent with the international guidelines and poor resources (ILO, 2002 e 2006).

It is rather difficult to compare the Italian quantitative studies on child labour conducted in the last decades because definitions, reference population and methods used have been radically changing. Nonetheless, these experiences have led to develop methodologies for analysing this topic and to identify the characteristics of economically active children.

Anyway studies on this matter do present some common elements. First, the most used instrument for empirical researches is a questionnaire handed to students in class. A second common element of the empirical literature is the limited territorial validity of the researches carried out, as they cover municipal areas or even sub-municipalities. This aspect helps data collection, but restricting the survey to small areas has led to statistical distortions in the quantification of the phenomenon at a national level.

In Prospect 1 we summarize the main estimates in the last decades reporting the authors, the year, the methodology used and the amount of the produced estimate. Among the main experiences, Istat and the Ministry of Labour, in 1999 started a research project focused on working children in all the important contexts in which they live. An experimental survey (National Survey on Child Labour) was conducted adding a specific model to Istat's quarterly Labour Forces survey (Istat-Ministero Lavoro, 2002).

We observe that, nor in the latest years neither at the moment, there are surveys or estimates procedure regarding the child labor.

Prospect 1- Main national estimates on child work /child labour

Year	**Source**	**Estimate** (thousand)	**Age class**	**Methodology**
1971	Ministry of Labour	240	< 15	Sample survey on small enterprises
1976	Censis	250-300	6-14	Sample survey on school drop-outs
1978	Ceres - Frey	235	10-14	Elaboration on Istat school drop-outs data and the Labour Force Survey
1979	Frey	430	10-14	Elaboration on Istat data and survey data on lower secondary schools in Lombardy
1988-1989	Istat	322	6-13	Household Multi-purpose Survey
1991	Censis	220-230	6-14	Estimates on school drop outs and survey data
1993	Unicef	200-300	< 14	Projections on their own sources
1993-1994	Sgritta	106	< 15	Retrospective survey on 35 thousand teenagers aged 18 at the call-up visits
1996	Cgil	50-100	< 14	Estimate on INAIL data on accidents at work and on the Ministry of Education data relative to school drop-outs
1996	Ilo	12	10-14	Presumably on the indicator relative to school drop-outs
1998	Istat	500	6-14	Household Multi-purpose Survey – Households, Social Subjects and Child Conditions
1999-2000	Cgil	360-430	10-14	Estimates based on a National qualitative survey and analysis of indicators from various sources
2000	Istat	144	7 - 14	Retrospective survey on teenagers aged 15 to 18 in the LF Survey
2004	Ires-Cgil	460-500	< 15 and 15-17	Survey carried out on 1,698 students from lower secondary schools in 9 large cities; survey on 409 children aged 11 to 14 and 113 children aged 15 to 17
2007	Ires-Cgil/Save the Children	623	< 15 and 15-17	Is the previous estimate considering also the effect of the raising of the mandatory schooling to 16 years of age

Source: Our elaboration on published estimates

3 Supplementary statistical indicators

In addition to surveys occasionally carried out to estimate the incidence and main features of child labour, some sources also offer current data on it. Though able to quantify child labour only partially, these data allow monitoring some aspects of the phenomenon. In particular, an important contribution involves the control activities of the Ministry of Labour, that produces annual data on the violations of the norms relative to child labour since 1999.

Since 1986, the INAIL has been providing data on accidents at work of 14-year old children. The ENPALS publishes yearly data on the authorisations released to children who want to work in the entertainment and fashion industry, revealing a rather consistent use of children in this sector. Finally, it is worth considering a phenomenon indirectly linked with child labour, that is school drop-outs.

4 Conclusive remarks

Though several methodological and estimation efforts made (which are characterized by a great variability of the methods used, despite the existence of guidelines provided by Simpoc ILO), child labour is still largely unknown. In particular, we completely ignore the so-called "Worst forms of child labour", that are the most at risk and in need of protective intervention. Even the statistical indicators currently produced by Public Institutions are not enough to describe and monitor the various realities of child labour.

We propose to develop an *Information system of official statistics on child labour*, providing both periodical surveys on the different components of child labour at national level and a forecast system based on administrative sources. Even policy measures on the subject on a territorial level should be included in the database. This would permit to researchers and policy makers an impact assessment of central or territorial policies . This would be more easily reached creating a permanent strategic coordination pool among all the public departments and institutions concerned.

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Statistical Information and Mass Media: the Diffusion of Census Data in the last 150th Years

Cristiana Conti, Daniela De Francesco, Simona Rosati, Anna Maria Tononi

Abstract. The dissemination of statistical data is a crucial factor in the portrait of social reality of a country. The mass media are able to influence the perceptions of individuals about statistical information. In this context, the daily press combines each activity of diffusion of statistical data from 1861 to the present. Today the traditional mass media are in fact supported by the new media (i.e. social network, blog, online press, etc.). The aim of the paper is to observe how the statistical information is changed from the Unification of Italy to the present. According to this perspective, what comes out is an exploratory operation on the development of press citation, the contents of the information and the communication strategies used. In particular, the analysis will focus on the dissemination of census data which contains privileged statistical knowledge addressed to all citizens. The empirical part will be developed through the data analysis (i.e. text mining) with the use of one of the most important Italian newspapers.

Keywords: Statistical information, Census, Daily press, Text mining.

1 The role of media: historical and working hypotheses

Much has been written about the role of mass media in modern society, their ability to "*construct reality"* and the social effects produced on the medium and long term. This work does not provide a comprehensive review of the positions of the many excellent writers who have confronted these issues or to propose new perspectives. Rather, based on what has already emerged from *communication research*, we want to examine the

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role of media in the diffusion of statistical information. In particularly, we want to analyzed the diffusion of census data from the Italian Unification to the present.

The working hypothesis is that it can return, through the choices made by the media in the dissemination of census data, an overview of issues on which it focused the attention of Italians in the hundred and fifty years of history. We believe that the media reflect public opinion, regardless of whether they arise – if, as McLuhan [9] said "*The owners of the media always strive to give the public what they want because they feel that their power is in the medium and not in the message or the program*" – or, conversely, are primarily responsible for its development, as proposed by the *agenda-setting* hypothesis [11].

In any case, downstream of any theory of mass communication, it is undeniable that what we find in newspapers reflects what is at issue in society.

2 Mass media and statistical information

The dissemination of statistical information media play a crucial role because, while the experts and institutions draw data directly from the source, the people implementing them mainly by the media [3]. A similar conclusion stated in the guidelines for media communications prepared by Unece for the national statistical organizations "*...the vast majority of the general population is unlikely to ever consult the national statistical organization directly. For most citizens, media provide their only exposure to official statistics*" [10].

If the media are so important in the dissemination of quantitative information to citizens, it must analyze the media's choices in selecting and reporting the data.

What seems to emerge is the existence of a *trade off* between detail but cool information and an information less annoying but not so precise. Readers seem to prefer the second approach and journalists adapt, for example by giving more emphasis on objective data less relevant to the life of the country but with greater appeal to the average reader, comforting in practice the theory of McLuhan [1].

3 The text analysis for census information

The aim of identifying the changes related to the perception of statistics in the last 150 years has inevitably directed the study on what is considered the first instrument of knowledge of Italian unification: the Census (conducted for the first time in Italy in the 31 December 1861). The results reported are the product of a statistical analysis on the articles extracted from the online historical archives "*La Stampa*", containing both the terms "*census*" and "*population*". They refer to three time periods: 1871-1875, 1951-1955, 2001-2005[ii]. Having to carry out an analysis of linguistic data, the textual statistic presents itself as a very useful method. It allows to analyze large and hardly text in a systematic and semi-automatic way, thanks to the help of computer programs. The

ii Altogether 144 items were collected as follows: 17 items for the period 1871-1875, 32 for 1951-1955, 95 for 2001-2005.

treatment of the texts considered was able to observe the diachronic evolution of the content of articles on the census, highlighting the appearance or disappearance over time of themes and words. Tab. 1 describes the characteristics of the textual corpus obtained after the normalization phase. It is a body of medium size large enough to conduct an automatic text: the lexical value of the extension infact is below 20% [7].

Table 1: *Main measures of metric vocabulary corpus* [iii]

Number of occurrence (N)	Number of forms (V)	Number of hapax (V1)	Lexical extension (V/N)*100	Lexical sophistication (V1/V)*100
80021	13926	7868	17,4	56,5

Sources: Data processing on historical archive online *La Stampa* by Taltac.

4 Census 1871, 1951 and 2001 in comparison

The three word clouds presented below have been constructed on the basis of results obtained by the analysis of the specificity of the corpus. Through this procedure it was possible to identify the characteristic words for each partition of the corpus (the three census periods). In the charts there are the words that have a specific positive overexploited (extracted from those with the lowest rate probable to appear in the text) [7]. The terms "*censimento*" (occ. 542), "*popolazione*" (occ. 338), "*abitanti*" (occ. 221), "*Italia*" (occ. 207) present an "*high frequency range*" [7] so they will be identify like the key-words of the total corpus.

The results for each period show an enrichment of the vocabulary used by media to describe the census data or activities. If the census of 1871 seems to emerge as an *operation*, in the 2001 *census* term became central and it is associated with higher possibility/need to study in deep data collected. The census unit, for example, is associated in 1871 with the term *election* or *tax* (referring to one of the administrative purposes of the Census), while in the 1951 and in the 2001 the vocabulary increases of the words *Italy* or *residents*, pointing out a more complex meaning of citizenship. In the 1951, also entering in the vocabulary the words *southern* while in the 2001 entering the term *foreign*, which compared with the term *colonies* of 1871 (the Census were also conducted in the colonized territories), make reference to historical evolution of the concept of *"foreigner"* and statistics related to it.

The type of information conveyed in different time census survey is to be found in the need for institutions to raise awareness through the press. It looks very current, in this sense, the passage of an article of 1881 which hoped for safer and more accurate results thanks *"alla cessazione quasi assoluta dei pregiudizi che lo reputavano uno strumento fiscale*" [6]. Or even article of 1961 entitled "*Perché nel censimento si deve dire la verità: non per scopi fiscali ma per conoscerci meglio…*"[8].

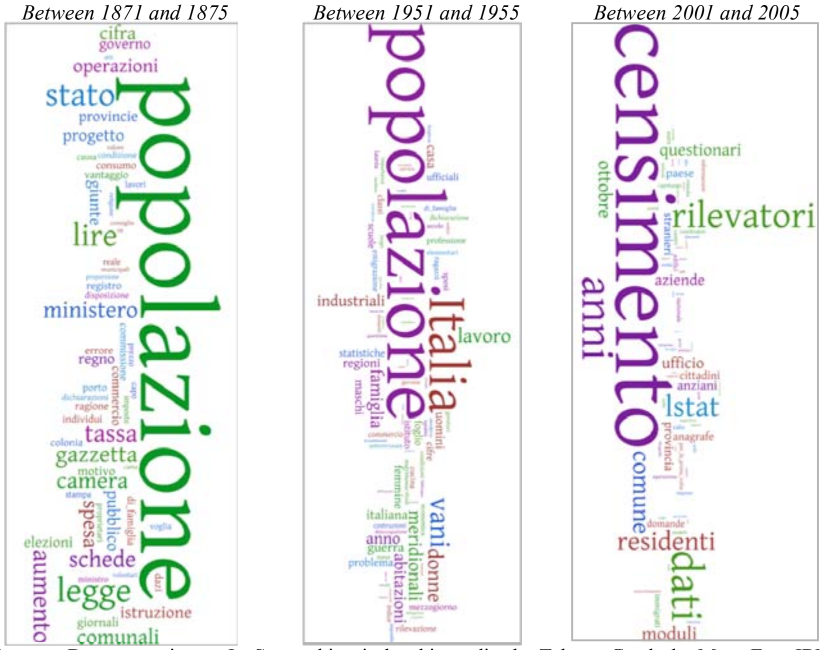
Additional analysis could be conducted by observing the three word clouds. Future developments may also affect the analysis of the title's articles, conducted over a period

[iii] N = total of the graphic forms (words); V = total of the specific forms (different words); hapax = words that appear in the corpus only one time.

from 1951 to 2001, with the aim of identifying the growing awareness of the media to the complexity of information assets offered by a general census. An initial screening done on articles published between 1951 and 1955 in three different newspapers sign of interesting lines of research.

Figure 1: The terms used in articles for La Stampa reported to the Census of Population

Between 1871 and 1875 *Between 1951 and 1955* *Between 2001 and 2005*



Sources: Data processing on *La Stampa* historical archive online by Taltac – Graphs by Many Eyes-IBM. Key-words are: censimento (occ. 542), popolazione (occ. 338), abitanti (occ. 221), Italia (occ. 207).

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High skilled migrants: administrative and survey data

Cinzia Conti and Domenico Gabrielli

Abstract
The Eu countries on the basis of the Regulation 862/2007 are required to provide data about the No-EU high-skilled migrants legally entered the country during the year.
None of the current data sources properly provides this kind of information. In order to supply to Eurostat the required information it is necessary to combine/integrate different sources: administrative (residence permits and Social Security notifications) and survey data (Labour Force Survey).
The paper will discuss the methods and the first results of this data integration procedure. It will underline also the general opportunities that the integration between administrative archives and sample surveys offers in the fields of immigration statistics.

1 Statistics on migration and international protection: trends after the European Regulation

The Regulation (EC) no. 862/2007 of the European Parliament and the Council of 11 July 2007 on Community statistics on migration and international protection represents an important improvement towards the harmonization of migration statistics at the international level and therefore for planning European migration policies.
The entry into force of the Regulation has introduced several innovations in the process of statistical production in the member countries. In some cases the information supplied for the European Regulation required the integration of different sources and to make estimates as the traditionally available sources are not always sufficient to such information

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In the final version of the guidelines for the provision of statistics on residence permits, member countries are required to identify the flows of high skilled immigrants. The guidelines provide that the high skilled workers were identified through the issuance of the blue card, a residence permit issued specifically for high qualified employment. Currently, however, the Council Directive 2009/50/EC on conditions of entry and residence of third-country nationals for the purposes of high qualified employment has not yet been implemented in Italy. It is therefore impossible to identify in this way high skilled workers.

On the basis of the Directive it is also possible define as “high skilled” the workers employed in high qualified remunerated activities. Information about this issue can be collected through different sources: residence permits Social Security notifications, Labour Force Survey. Each source, however, presents limits; for example Labour Force Survey cannot identify the required levels of breakdown and the of quality of residence permits data is not always consistent with the guideline.

Consequently the decision to integrate the different sources at a micro and macro level has been taken in order to:

1) check the quality of information on professional activity acquired through residence permits;
2) integrate the information when there is no indication on the permit;
3) identify on the basis of the reconstructed information high-skilled workers;

The first step of the procedure will be discussed, focusing on the micro level integration between residence permits and the social security notifications.

2 The micro data integration

In a first step a record linkage between residence permits data and Social Security notifications has been carried out. The new residence permits issued for work reasons during 2008 have been linked with the records of the employees for reference year 2009. The Social Security archive contains data relating to declarations of contributions for employees made in 2009, with the exclusion of the public sector. From the archive are also excluded agricultural workers and domestic workers, which refer to other archives. These categories appear in the archive used for record linkage only in some specific cases (temporary workers).

As first step, records referring to people born abroad (information derived from the tax code) were selected from the Social Security archive.

The procedure (deterministic) for record linkage used as key the tax code; this variable is found in both files for almost all cases: 99.4% Social Security, residence permits 88.3 %.

It was possible to link with the records of the archive INPS 51,920 123,719 permits issued for work reasons in 2008 (42%)[1].

The information on the profession registered through residence permits is missing in 5,992 linked cases. For these individuals will be possible to integrate the lacking information with data deduced from the Social Security archive .

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[1] The percentage of linked records is considered satisfactory as domestic workers are not included in the Social Security archives.

Linkage results, of course, are different depending on the professions recorded on the permit, as mentioned, in fact, the used Social Security archive excludes some categories of workers. The linkage gives better results for those who are registered as manual workers on the basis of residence permit (35% of the inflow in 2008) that are "covered" for 67%).
In order to check the consistency between the information about professional activity contained in the two files, the original classification of INPS was re-aggregated by identifying three categories: unskilled (apprentices, manual workers, domestic workers, travelling salesman or, apprentice manual workers), employees (employee, intermediate clerks, apprentice employee) and qualified (journalists, workers with the position of executives, managers, business executives).
The 97% of those registered as manual workers on the residence permit are properly placed in the category "not qualified" (90% are also recorded in the archive INPS specifically as manual workers).
Among the unskilled occupations, the consistency between the information of the two archives is high for: waiters, cleaners, building workers (Tab.1).

Table 1: *Flows of residence permits issued for work reasons during 2008, by selected professions declared on the permit and correspondent level of skill on the basis of Social Security archive classification*

Profession declared on the residence permit	**Residence permits for work reasons**	**Type of profession registered in Social Security archive**			**Percentage of successful links with the records of Social Security archive**
		Unskilled	**Employees**	**High skilled**	
Manual worker	43660	28348	903	48	67.1
Domestic worker	41967	9208	538	3	23.2
Caregiver	12647	1147	76	0	9.7
Building workers	1896	1327	5	0	70.3
Shop assistant	1448	877	220	0	75.8
Cleaner	1366	818	25	0	61.7
Waiter	1128	881	32	1	81.0
Manager	388	0	82	131	54.9
Engineer	302	0	102	48	49.7
Total	123719	48614	3016	285	42.0

Domestic workers which represent 34% of incoming flows only in a very low proportion can be found in the archive INPS: 23%. In the case of those who are classified, according to residence permits, as caregivers (10%) the proportion found in the Social Security archive is far less: about 10% and in almost all cases are not as qualified. The absence of INPS archive of these individuals can be considered as evidence in favour of the reliability of information recorded on the permit, as mentioned, in fact, domestic workers are registered in other archives.

The final purpose of the record linkage is to identify the share of high skilled workers. On the basis of the information derived from the residence permits they represent a small percentage of the total inflows. The 55% of the individuals registered as "managers" on the basis of residence permits have been found in the Social Security archive. In this archive the 61% are classified as managers, in the remaining 39% of cases are classified as employees. Also for the engineers and teachers the classification of Social Security does not largely differ from that of permits.

This record linkage could represent a first step towards an evaluation of quality of information registered on the residence permit.

3 Survey and archives

Another line of analysis is to compare the data gathered by the Labour Force Survey with administrative data. The Labour Force Survey for its structure and purpose, is the source that can give the most accurate and detailed information about work activity, profession and skill level of foreigners.

It must be stressed that the LFS concerns the stock of foreign nationals and not the flow of regular immigrants, furthermore it cannot provide the requested breakdown for each citizenship.

The richness of the survey about the professions then, while, on the one hand, represents a resource, on the other hand leads to relevant problems for the integration with information from other sources less detailed.

The first step, in fact, for the integrated use of different sources at the macro level is essentially the harmonization of reference metadata.

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Social Media Channels as Drivers For The 6th Agricultural Census Change

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Abstract The aim of this paper is twofold. Firstly, main changes due to the introduction of the use of Facebook in the 6th Agriculture Census will be outlined. Users' experiences collected during the first phase of the survey are presented in a text analysis of contents of Census Facebook page. Secondly, an international benchmarking exercise will detect best practices implemented by National Statistics Institutes in the social media channels use for census surveys.

Keywords: Social media channel, Agriculture census, Text mining.

1. Introduction

The presence of National Statistics Institutes on Web 2.0 is a worldwide practice. Social media channels favour interactive and prompt communication of statistical information. In addition, emerging issues can be shared with stakeholders, both institutional and final users. Real time communication realized through social media channels overcomes the concept of distance in time and space between producer of official data and final users. Census surveys are featured by critical unforeseeable phases in ex-ante planning. In this way, the use of an on-line platform can offer positive and negative aspects in emergency management.
The benefits expected from the FB page of the 6th General Census of Agriculture are:
- to reach web users through Facebook, especially holdings, citizens and young people;

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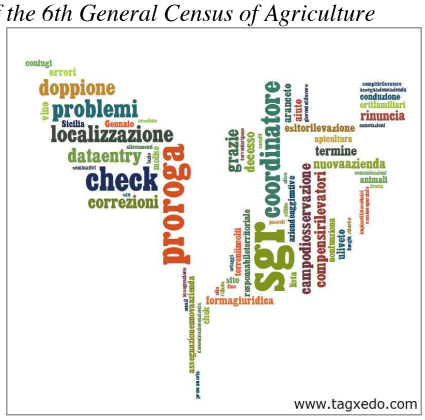
- to create a Census community;
- to allow who is involved in the Census to share information (and opinions);
- to exploit the viral power of the social media, using Facebook as a multiplier of services and information content disseminated through the Agricultural Census website (events, videos, etc.);
- to be recognized as an open and innovative organization.

2. Use of Facebook in the 6th Agriculture Census in Italy

The Facebook page of the 6th General Census of Agriculture (active from 5 October 2010) presents a high level of interchange with its 7,265 members (at the date of 3 May 2011). Considering the 211 days of activity, there are a total of over 24,000 comments (17,820) and posts (6,817) published on the *wall*. A more exact idea of the level of information collected and disseminated by the Page is to be found by considering the average daily traffic that brings together over 500 unique visitors, 559 active users, 32 posts and 84 comments for day. The values become even more important considering the days of peak, with 412 posts and comments managed within a single day.
Analyzing the collected posts appears primarily a personification of the concept of Census. The nickname used by Facebook users to ask help and support was perhaps "Census" or "Mister Censi": "Mr Censi can you help me?", "Census, are you there?". The page of the Census has fulfilled numerous concerns raised by the enumerators and, in second time, by the companies. Taking the example of two of the days with the largest number of interactions (25 November 2010 and 26 January 2011 respectively with 412 and 277 comments/post) most of the questions, as shown in the tag cloud, refer to the informatics' problems (SGR - Survey Management System - is the term most posted both days), followed by questions relating to specific sections of the questionnaire (such as the conduction system, the location of the company, the outcome of the survey, etc..) and the field of observation.

Tag cloud about the Facebook page of the 6th General Census of Agriculture

Posts published 25 November 2010



Posts published 26 January 2010

Finally, the last period more than 100 posts have been published by the enumerators to communicate the end of their work with the desire to thank the Facebook page and share their experience with the community (in the finally paper we would like to present the most kindly post).
About this first experience it is possible to say that only a few expected benefits were achieved, as increasing use of web-based tools, the creation of a virtual community, the positive management of emergencies (this has also led to a constant demand page tracking by Istat). In this prospective, we collected international best practices in implementing future management of the Facebook page.

3. A comparison of the best practices and foreign experiences

Best practices implemented so far by National Statistics Institutes in the social media channels use for census surveys can be detected through an international benchmarking exercise, with the purpose to highlight potential developments of the Facebook page of the 6th Agriculture Census in the prospect of forthcoming data dissemination phase.
On the basis of the table presented above, and the communication plans of international Statistics Institutes of countries involved in census operations, we use the following indicators to identify the best practices[1]:

1) Number of social media channel. It's the number of social media channel used for census communication.
2) Heterogeneity of information. It's the different kind of information published on Facebook page (statistical, promotional, articles, etc.). It depends on Facebook page posts, documents and discussion.
3) Proactivity. It's the possibility to post messages on Facebook page from users, presence of discussions and application for users, etc..
4) Attractiveness. It's the heterogeneity of user profile (enumerators, resident, etc.)

The following table shows the results:

Country census object	**Number of social media channel**	**Heterogeneity of information**	**Proactivity**	**Attractiveness**
United States	5	4	5	4
Mexico	2	3	2	4
Dominican Repubblic	3	2	1	1
Costa Rica	4	-	3	2
United Kindom	4	-	4	5
Australia	3			
Brazil	3			
Venezuela	2	-		

1 The first indicator is quantitative. It gives a full-value, we consider good performance for hight values.
The other indicators are qualitative. They give a number included between 1 and 5:
1 = insufficient 2 = mediocre 3 = sufficient 4 = good 5 = very good

4. Conclusions

The FB page, used so far to give information about the Census and support data collection, in the next month will become a tool for dissemination of provisional results. Rather than the communication of specific objectives, Istat has had to interact in an ongoing dialogue with stakeholders on issues not always predictable, since Facebook is a place where everyone has the right to speech, so that content control by the page masters was impossible. However, punctual and real time answers were essential to maintain credibility of the Institute: such incredibly frequent exposure, the speed of reaction time and the need to share the replies have led Istat to a more precise definition of its communicating style, in other words its “brand character”.
In conclusion, by the experience of the Facebook page of the Agriculture Census we can firstly learn that it is essential a constant monitoring of the channel through rapid action and clarity in the responses. Secondly, observing the international best practices too, it’s important to base the Facebook page on a well-defined communication strategy of the Institute, which must be ready to manage an emergency that may precipitate, to be able to redirect the adopted strategy in order to maintain the control of the channel. Giving everybody the possibility to post a comment, it’s necessary to trying to anticipate every possible situation that can be variable over time, defining in advance how to respond and interact with "friends" page.

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Contributions of Italian statisticians to the development of multivariate data analysis

Renato Coppi and Paolo Giordani

Abstract The main contributions of Italian statisticians to the methodology of multivariate data analysis are investigated, focusing specifically on the development of techniques for coping with the extraction of information from complex data characterized by two or more variables or sets of variables as observed on one or more sets of objects. In particular the following types of methodological areas are considered: supervised and unsupervised classification, regression, factorial and scaling approaches. Methods for dealing with different sources of uncertainty associated with the procedures for drawing information from the data are examined with reference to: sampling uncertainty, model uncertainty, imprecision/vagueness of the data. The Italian contributions are discussed in the framework of various lines of research, including: analysis of contingency tables, asymmetric relationships among sets of variables, multiway data analysis, fuzzy and symbolic data analysis, textual analysis, stability analysis and model selection. Although the bulk of this study is devoted to the works appeared in the last three or four decades, some hints are given to the historical profile of the Italian school of Statistics. In this connection it is underlined that the more recent developments are characterized by specific traits of originality, which place the Italian contributions to the aforementioned fields of research somehow at the crossroads among the French, the Dutch and the Anglo-American schools of Statistics.

Key words: History of Statistics, Multivariate Analysis, Regression and Classification, Association, Fuzzy data, Multiway data

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1 Introduction

Data analysis has historically been characterized by a "dualistic" perspective. On one side, statistical data have been looked on as being generated by a probabilistic model most often expressed in parametric terms. Typically, inferential procedures based on the likelihood have been adopted for analyzing the empirical information conveyed by the data. The Anglo-American school of thought has greatly influenced this approach. On the other side, the data have been viewed as containing an intrinsic information, independently of any prior knowledge concerning their generation process. In this case, the analytical procedures have been devised in such a way as to discover and display the empirical information by means of appropriate representations of the data in geometric or algebraic structures, utilizing the formal properties of these structures for carrying out the analyses (Principal Component Analysis, Correspondence Analysis, Cluster Analysis, are examples of this approach, if we look at them from an "exploratory" viewpoint). The French school of "Analyse des Données" has typically represented this line of research particularly in the period 1960–1980. A third perspective has appeared in the literature in the 80's and 90's, mainly inspired by the Dutch school of data analysis [47]. This may be defined as "anti-dogmatic", since it is based on flexibility and eclecticism. Although the observed data must drive the procedures of information extraction, an instrumental role is also assigned to statistical models including probabilistic mechanisms that enable the investigator to validate and generalize the results obtained from the analysis of the available data. Alternating least squares algorithms constitute the basic computational tools for implementing the analytical procedures; resampling techniques are often adopted for testing and validation. The school of "Statistical Learning" [88, 55] has many points in common with the latter line of thought, although it puts more emphasis on the probabilistic tools due to the fact that an underlying unknown stochastic process of data generation is assumed and the predictive perspective of the analysis is strongly underlined.

In our paper, we focus on the contributions of Italian statisticians to the domain of multivariate data analysis, restricting our attention to the developments of the "exploratory" approach, including the possible use of probabilistic tools (an interesting previous review of the Italian contributions to this field of analysis is by Balbi [2]). In this respect, it can be stated that the lines of research of Italian scholars have taken inspiration from each of the above mentioned schools of thought, thus realizing a sort of compromise among different ways of looking at the data, with the aim of enhancing and representing in various manners the information embodied in the empirical observations. In this connection, it is evident the link with the traditional characteristics of the Italian school of Descriptive Statistics. One basic feature of this school has historically been the endeavour to incorporate in the statistical tools for analyzing real world phenomena their *complexity*, without introducing too many theoretical assumptions. While in the first half of the 20th century, this attitude has mainly produced a wide range of descriptive statistical indices for both univariate and multivariate set-ups, in the second part of the century and more remarkably in the last three decades it turned towards the construction of methods for handling

the information contained in complex dependence and interdependence structures among and between sets of variables and for detecting meaningful typologies of statistical units. At the same time, a specific interest has been focused on the analysis of what can be called "complex" statistical observations. In this category we include multiway data arrays as well as special empirical objects like interval-valued or fuzzy-valued variables or, more generally, symbolic data.
In the sequel we will mention some of the numerous contributions provided by Italian statisticians to the above fields of methodological research. In doing that we will limit ourselves to the works whose inspiration is more close to the exploratory perspective rather than to the inferential probabilistic viewpoint. Of course this does not exclude that some of the considered contributions are, in some sense, "model-based" and make use of probabilistic tools. As a matter of fact, this use might be interpreted in the above mentioned framework of the Dutch school, i.e. just as technical means for drawing information from the data and possibly evaluating its statistical reliability. Another preliminary remark concerns the selection of works that we will consider. Due to the practical impossibility of covering the great deal of interesting contributions in the fields under investigation, we have limited the illustration to a small part of the scientific production of interest, trying to enhance the main lines of research rather than detailing the specific proposals. Therefore, we apologize in advance for all the citations that have been missed, while we recognize the value of the overall contribution of Italian scholars to the domain of multivariate data analysis, with particular reference to the many statisticians involved in the activity of the CLADAG section of the Italian Statistical Society. The following discussion is divided into four parts, referring respectively to: Regression and Classification, Association structures, Interval and Fuzzy Data, Multiway Data. Due to the limited size of the present paper, the illustration will be very schematic, thus the reader is invited to look at the bibliographic references for getting a deeper insight into the various topics.

2 Regression and Classification

Several lines of research have been followed in this domain, with the common aim of taking into account the complexity of real world dependence structures for both quantitative and qualitative response variables. In this perspective, some of the works look for improving methods and techniques of common use, while some other works suggest new approaches or propose new methods of analysis.

2.1 Decision Trees

Noticeable contributions to classification and regression procedures based on decision trees have been provided by Conversano, Cappelli, Mola and Siciliano (see, e.g., [12, 15, 85]). These contributions concern several aspects, including the improvements of decision trees methodology and its use in various data analysis situations (data mining, imputation of missing data, etc.). In this area several other Authors provided interesting proposals. For instance, Miglio and Soffritti [69] introduced suitable proximity measures between Classification trees, which can also be utilized for finding parsimonious optimal trees from among a set of possible trees [68]. Another direction of research consists in enlarging the scope of the classical CART trees to include, for example, ordinal response variables. Suitable splitting criteria have been introduced by Piccarreta [71] to this aim, utilizing a new measure of association between categorical and ordinal variables [72].

2.2 Clustering

Concerning traditional algorithms of cluster analysis, such as the *k*-means method, various Authors have provided useful suggestions for improving their efficiency in detecting underlying typologies which can be captured by looking at the empirical features shown by the distribution of the observed units in the space. The use of appropriate metrics and of suitable weights for the observations allows for remarkable improvements in this direction (see, e.g., Cerioli and Zani [13, 14]). The problem of a simultaneous dimensionality reduction and clustering procedure has been faced by Vichi, Rocci and Vicari in several works , with reference to units $\times$ variables matrices (see, e.g. [82, 90, 95]) and also with respect to proximity matrices by means of an appropriate utilization of multidimensional scaling [57]. The problem of clustering variables rather than units has been, for instance, faced by Laghi and Soffritti [64] who proposed a procedure based on suitable measures of collinearity within groups (clusters). Along this line of research a generalized double *k*-means technique has also been proposed by Vichi and Rocci for simultaneously clustering the units on one side and the variables on the other side [96, 97]. In the field of model-based clustering, Vichi [94] has proposed a procedure for fitting the "closest" classification matrix to an observed proximity matrix through the use of least squares. Another approach in this domain is by Galimberti and Soffritti [46] who introduced model-based procedures for detecting multiple cluster structures, namely typologies of units based on different subsets of a set of observed variables.

2.3 Statistical Learning approach

A new perspective for regression and classification studies was introduced by the Statistical Learning approach, which puts particular emphasis on the predictive viewpoint and on the use of computer intensive techniques based on boosting, bagging and random forests procedures, enabling the researcher to improve the predictive efficiency of regression and classification models. Systematic contributions to this line of research have been provided by Di Ciaccio and Borra in several works. For instance in [7] they use bagging and boosting for improving the prediction capability of non-parametric regression techniques. In [8] these Authors suggest appropriate methods to compare classifiers and select the predictors, whilst in [9] they investigate various ways of measuring the prediction error in regression and classification problems and propose some methodological improvements. In the same line, other Authors, like Sandri and Zuccolotto [83], suggest how to use random forests for selecting predictors in a classification problem. La Rocca, Perna and Giordano [53] devise suitable resampling procedures for selecting variables in neural network models for regression analysis and, more generally, contribute to the regression and classification methods based on neural networks (e.g. [70]).

3 Association structures

This is a wide field of analysis whose objective is to detect and display observable or latent structures of association within and between sets of variables. In the following we will just mention some interesting lines of research to which the Italian statisticians gave a noticeable contribution.

3.1 Non symmetrical analysis with reference space

Starting from the seminal paper by D'Ambra and Lauro [33] concerning the analysis of multivariate data with respect to reference subspaces, a line of research has been developed in the field of association structures, consisting in an asymmetric approach to the analysis of relationships among several variables taking into account the influence of "external" variables. the original idea was to study the association structure of the projections of the investigated variables onto the subspace generated by the "external" ones. This idea has been thereafter suitably manipulated in order to offer reasonable solutions to the problem of incorporating the information carried by instrumental or exogenous phenomena in the various studies of association in a set of variables of interest. The paper [60] well illustrates these potentialities, while in the works [4, 66, 67] it is shown how the application of this approach to three-way contingency tables gives rise to a new method called non-symmetric correspondence analysis, allowing to deal with ordinal variables. In the last decades, different authors tried to decompose association measures for three-way contingency tables. In this perspective, papers by Italian scholars involved in the analysis of three-way contingency tables can be found in [5, 65, 67, 86, 87].

3.2 Partial Least Squares approach

Another line of research refers to the improvement and utilization of the Partial Least Squares (PLS) approach in the analysis of several types of association structures. Esposito Vinzi and various co-authors introduce the "Generalized PLS Regression" model [3], which basically allows a transformation of the explanatory variables into orthogonal components in order to improve the fitting to a quantitative or qualitative response variable, by using an appropriate iterative non-linear least squares algorithm. Esposito Vinzi, Lauro and others [89] discuss and improve the procedures of "PLS path modelling", which adopts the PLS approach for estimating suitable structural equation models. Moreover, the Authors show that it can provide a general framework for analyzing a multi-block structure of observed variables. A special issue of Computational Statistics and Data Analysis [43], edited by Esposito Vinzi and Lauro, has been devoted to the various methodological improvements of the PLS approach in several areas of multivariate analysis.

3.3 Asymmetric Multidimensional Scaling

Combining the information contained in the proximities between statistical units with the values taken by "external" variables on those units, may lead to a deeper analysis of association through the use of multidimensional scaling procedures which allow also useful visualizations of the results. This line of research is witnessed, for instance, by the works of Bove and Rocci with particular reference to asymmetric proximities (see, e.g., [10, 11, 78]).

4 Interval and Fuzzy data

Interval data, fuzzy data and, more generally, symbolic data represent complex observations requiring particular techniques of analysis. This "complexity" may be due to: (1) imprecision/vagueness of the observed variables, (2) intrinsic complexity of the observed phenomena (represented as "symbolic objects"). Source (1) constitutes a type of uncertainty which needs special methods of treatment, (2) involves a specific mathematical representation of "non-standard" variables. We focus our illustration on type (1) data, which represent anyway relevant instances of symbolic data (to whose study are addressed many works, in particular, by Verde; see, e.g., [59, 63]).

4.1 Interval data

Italian statisticians have given remarkable contributions to the analysis of interval data, generalizing in various ways the techniques of Principal Component Analysis (PCA), Cluster Analysis and Regression, in order to make them suitable for the analysis of this type of complex data. Concerning PCA, Lauro and Palumbo [61, 62] and subsequently Gioia and Lauro [48] have worked on intervals represented as boxes (or hyperrectangles) in Euclidean spaces looking at their vertices and ranges. Coppi, D'Urso and Giordani [23, 39] utilize a "data reconstruction" approach based on a Midpoint-Radius representation of the intervals. Approaches to cluster analysis of interval data have been proposed by, for instance, D'Urso and Giordani [42] and Irpino and Tontodonato [58].

4.2 Fuzzy data

Also in the field of fuzzy data many important contributions of the Italian statisticians are to be recorded. A systematic program of re-interpretation of the classical PCA, clustering and regression techniques in terms of fuzzy data is being realized. In particular, Coppi, D'Urso, Ferraro and Giordani have produced a series of papers in this direction. Basic ingredients of these extensions are: (1) the formalization of fuzzy observations in terms of LR fuzzy numbers; (2) the introduction of appropriate metrics for LR fuzzy variables; (3) the construction of specific models for each of the above fields of analysis (PCA, cluster analysis, regression), incorporating the fuzziness of the observations; (4) the definition of suitable algorithms for estimating the parameters of the introduced models (generally iterative least squares procedures); (5) the possible utilization (in particular for regression analysis) of the notion of Fuzzy Random Variable, which enables the investigator to cope simultaneously with the uncertainty stemming from the imprecision of the data, and the one due to an assumed probabilistic mechanism generating the observations. A partial list of the contributions provided in the above framework is as follows. Concerning PCA of fuzzy data [28, 40, 51]. For cluster analysis of fuzzy data and fuzzy multivariate trajectories [25, 41]. As to regression analysis with fuzzy response and crisp or fuzzy explanatory variables [26, 36, 44, 45]. Finally, it must be underlined the publication of a special issue of Computational Statistics and Data Analysis, edited in 2006 by Coppi and others [27], devoted to the recent developments of Fuzzy Statistical Analysis.

5 Multiway analysis

Data generally refer to the observations of some variables on a set of units and are stored in a (two-way) matrix. However, in several situations, data on a set of units on some variables are assumed to be collected in different occasions, leading to a (three-way) array. In this section, we shall limit our attention to the Italian contributions to the topic of multiway data analysis distinguishing two lines of research, namely component models and cluster analysis.

5.1 Component models

At the beginning, the Italian statisticians involved in multiway analysis took inspiration from the French school. In this connection we cite the works by Bolasco [6], Coppi [16] and Coppi and Zannella [21]. Notice that in [21] the so-called Dynamic Factor Analysis has been introduced. Later, it has been extended and generalized (see [19, 22, 29]). In the following years, the Italian statisticians spread their research interests to the methods inspired also from the other schools acquiring an impressive importance within the world multiway community. The success of the meeting 'Multiway'88' held in Rome bears witness to the Italian contributions to multiway analysis. The proceedings of the conference [17] represent a milestone within the domain. The most relevant findings of Italian statisticians to the Tucker3 and Candecomp/Parafac models and related methods were given by Rocci [56, 77, 79, 80]. Extensions of such models to imprecise and/or vague data were proposed in [49, 50, 52]. Other contributions on component methods can be found in [1, 30, 34, 73, 75, 76, 92]. Finally, it is useful to mention the special issue of Computational Statistics and Data Analysis on multiway models edited by Coppi and Di Ciaccio [18], which offered the current (in 1994) world state-of-art of multiway analysis.

5.2 Cluster analysis

The clustering problem for multiway data has been deeply addressed by Italian statisticians. As far as we know, Rizzi [74] was the first one involved. At least three lines of research can be highlighted. The first one concerns the attempt to look for a sort of compromise partition built on the basis of the set of partitions for all the occasions. Therefore, the research interest is to find the single partition synthesizing at best, according to a given criterion, K available two-way partitions (one for each occasion). In this connection the contributions of Vichi deserve to be cited [54, 93]. Another approach consists of seeking clusters of units considering the data array as a whole, in the sense that no distinct partitions for each occasion are assumed. Thus, in this respect, the data taxonomy is sought by considering the features of the units as the information on a number of variables in different occasions. Rocci, Vicari and Vichi played an active role in this domain [81, 91, 98]. Notice that a few of these papers also involved a reduction of the entities of the variable and occasion modes through a Tucker3 model. Finally, the third line of research is about fuzzy clustering for time trajectories. In this case, the occasion mode is the time and data consist of the same variables observed on a number of units in different time occasions. Every unit can then be seen as a multivariate time trajectory. The aim of the analysis is to find a limited number of clusters composed by trajectories homogeneous according to suitable dissimilarity measures. Findings in this domain are due mainly to D'Urso also in collaboration with Coppi and Giordani [20, 24, 35, 37, 38].

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Bayesian Spatial Autoregressive Panel Data Models: An Application on ISTAT Value Added provincial dataset using GNU Octave and Parallel Computing

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Abstract The policies of economic activity developed by European Union (EU) and the role played by regions and provinces as economic subjects have called for a larger set of disaggregated statistics at a macro, regional and provincial level. This paper illustrates an innovative technique to analyze Provincial Accounts from a bayesian perspective. The aim of the article is to show how Spatial Bayesian Autoregressive Panel Data Models could be computed generating a huge amount of random draws cutting down hardware and software costs.

The analysis is made considering the official Italian economic provincial value added data. Finally some conclusions are drawn on the comparative performances of distinct models proposed by literature.

The computational burden of the various procedures is very heavy and the results are obtained by using parallel computing by GNU Octave as matrix programming scripting language installed on an heterogeneous GNU Linux computer cluster.

Key words: Bayesian Spatial Autoregressive Panel Data Models, Italian Provincial Accounts, Parallel Computing

1 Introduction

In recent years, the spatial econometrics literature has exhibited a growing interest in the specification and estimation of econometric relationships based on spatial panels. This interest can be explained by the fact that panel data offer researchers extended modeling possibilities as compared to the single equation cross-sectional setting, which was the primary focus of the spatial econometrics literature for a long

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time. To estimate spatial panel data models, Elhorst has provided Matlab routines at his website www.regroningen.nl/elhorst for both the fixed effects and random effects spatial lag model, as well as the fixed effects and random effects spatial error model. On the other hand James P. LeSage (1999) had showed how to estimate cross-section Bayesian spatial autoregressive models, before Elhorst extended the analysis for panel data models. One objective of this paper is to extend and apply these LeSage's researches concerning Bayesian framework to spatial panel data models using Italian Provincial Value Added and Full time equivalents time series in terms of first log differences.

2 Fixed Effect Spatial Autoregressive Models

The spatial lag model is formulated as

$$\begin{aligned} \Delta log(Y) = \rho W \Delta log(Y) + \Delta log(X)\beta + \mu + \lambda + \varepsilon, \\ \varepsilon \sim N(0, \sigma^2 \cdot I) \end{aligned} \tag{1}$$

The dependent variable's vector for cross-sectional unit i at time t is $\Delta log(Y)$.

The $1 \cdot K$ vector of exogenous variables is $\Delta log(X)$ and β is a matching $K \cdot 1$ vector of fixed but unknown parameters. The matrix W denotes the interaction effect of the dependent variable with the dependent variables in neighboring units. More in detail w_{ij} is an element of a pre-specified nonnegative $N \cdot N$ spatial weights matrix W describing the arrangement of the cross-sectional units in the sample.

The response parameter of the endogenous interaction effects, ρ, is assumed to be restricted to the interval (1/rmin, 1), where rmin equals the most negative purely real characteristic root of W after this matrix is row-normalized. W is built using latitude and longitudes coordinates of Italian Provinces. μ denotes a spatial specific effect and λ a time-period specific effect. Spatial specific effects control for all space-specific time-invariant variables whose omission could bias the estimates in a typical cross-sectional study, while time-period specific effects control for all time-specific effects whose omission could bias the estimates in a typical time-series study.

In the spatial error model, the error term of unit i, ϕ_{it}, is taken to depend on the error terms of neighboring units j according to the spatial weights matrix W and an idiosyncratic component ε_{it}, or formally

$$\begin{aligned} \Delta log(Y_t) = \Delta log(X_t)\beta + \mu + \lambda + \phi, \\ \phi = \rho W \phi + \varepsilon_t \\ \varepsilon \sim N(0, \sigma^2 \cdot I) \end{aligned} \tag{2}$$

where ρ is called the spatial autocorrelation coefficient. Clearly both models could be combined in wider one.

$$\Delta log(Y_t) = \rho_1 W \Delta log(Y_t) + \Delta log(X_t)\beta + \mu + \lambda + \phi, \tag{3}$$
$$\phi = \rho_2 W \phi + \varepsilon_t$$
$$\varepsilon \sim N(0, \sigma^2 \cdot I)$$

It is also possible to show that by a particular demeaning transformation we get rid of μ and λ to maximize a quite similar log-likehood function already implemented by Le James P. LeSage in his spatial-econometric Matlab's software.

3 Relaxing homoscedasticity assumption

Indeed is it possible to estimate the transformed model that takes into account heteroscedasticity. Without loss of interest is it possible to outline the whole procedure considering only the spatial autoregressive model (see 2). Following LeSage, we assume that the conditional distribution for β assuming that we knew σ and V would looks as follows:

$$\beta|(\sigma, V) \sim N[H(X'V^{-1}y + \sigma^2 T^{-1}c), \sigma^2 H],$$
$$H = (X'V^{-1}X + T^{-1})^{-1} \tag{4}$$

c and T represent respectively a diffuse prior about β means and a diffuse prior about variance matrix V. Next consider the conditional distribution for the parameter σ assuming that we knew the parameters β and V in the problem. This distribution would be:

$$[\Sigma_{i=1}^{n}(e_i^2/v_i)/\sigma^2]|(\beta|V) \sim \chi^2(n) \tag{5}$$

Geweke (1993) shows that the conditional distribution for the parameters V represent a χ^2 distribution with $r+1$ degrees of freedom as shown here:

$$[(\sigma^{-2}e_i^2 + r)/v_i](\beta, \sigma) \sim \chi^2(r+1) \tag{6}$$

The Gibbs sampler summarized formally in equations 4, 5 and 6 might be implemented as follows:

1. Begin with arbitrary values for the parameters β^0, σ^0 and v_i which we designate with the superscript 0.
2. Compute the mean and variance of β using 4 conditional on the initial values σ^0 and v_i.
3. Use the computed mean and variance of β to draw a multivariate normal random vector, which we label β^1.
4. Calculate expression 5 using β^1 determined in step 3 and use this value along with a random $\chi^2(u)$ draw to determine σ^1.
5. Using β^1 and σ^1, calculate expression 6 and use the value along with an nvector of random $\chi^2(r+1)$ draws to determine $v_i, i = 1, \ldots, n$.

4 GNU Octave 3.4.x and MPI bindings

Clearly we could build up a sample (e^j, σ^j, v_i) of j values from which we can approximate the posterior distributions for our parameters. Recently Corradini in 2010 implemented an ad-hoc software for parallel computing routines available on www.octave-forge.org web site. By these and some light modifications concerning the log-likehood function maximization is possible to distribute the random draw simulations on a low cost refurbished debian linux squeeze 6.0 computer cluster. Once the parallel procedure is executed it is possible to check proper model specification drawing any suitable amount of random draws for any model mentioned above (see also Fig. 1).

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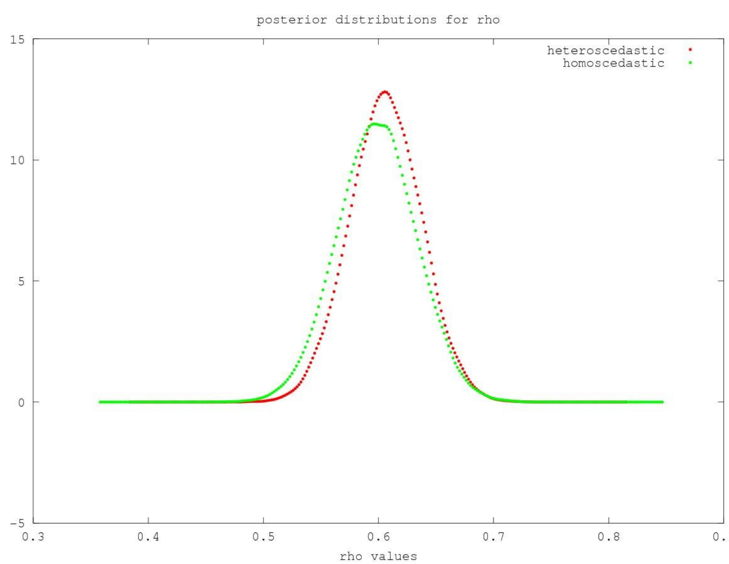

Fig. 1 rho distribution Costruction - simple SAR pooled OLS $\Delta log(VA) \Delta log(FTE)$ 1996-2007-500000 random draws

A Special Gen(d)re of Statistics: Roots, Development and Methodological Prospects of a Gender Statistics

Un certo genere di Statistica: radici, evoluzione e prospettive metodologiche della Statistica di Genere

Franca Crippa, Patrizia Farina e Fulvia Mecatti

Abstract. The interpretation and the related use of whatever goes under the denomination Gender Statistics is twofold. The first approach is traditional, in line with the popular representation of statistics as a collection of typical products such as indexes, tables and graphs. In this view, the gender issues are so far faced and solved by declining by gender all statistics formerly conceived for the overall population. From a broader and forward-looking perspective, Gender Statistics need to look beyond the sheer data disaggregation. A turning point is urged by the increasing demand of gender sensitive statistical information coming from society, official agencies, and economy. On the premise of the quality of data for women and men as an essential prerequisite, *Gender Statistics* stands as a proper independent field of statistics with its own objectives which cut across various applications in social and human sciences, in an emerging need of appropriate methodological techniques and dissemination tools. These scientific resources should be available to researchers with interdisciplinary backgrounds, with the aim of highlighting, evaluating and understanding gaps and issues based on either gender - as a social structure – or sex – as a biological factor.

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Introduction

The formal and global request for distinct statistical information on women and men goes back to the seventies, namely to 1975, declared by ONU the International Year of Women. The issue of statistics on women was posed at that time, at the First World Conference on Women in Mexico and its echo resounded to the Second World Conference in Copenhagen in 1980 and then through the subsequent five years' World Women Conferences. Among statistical offices, Statistics Sweden was one of the first in the world to designate specific staff to work on gender statistics, starting in 1983. The 90's turn in favour of statistics on women *and* men - *i.e.* on gender - led to the 1995 Beijing Fourth World Conference and to the 2000 Millennium Declaration as major boost to the development and affirmation of a Gender Statistics.

Henceforth, the approach of gender statistics had spread to many national statistical offices and international agencies, primarily in the form of data disaggregation by gender from conventional censuses and surveys. Later, this raw disaggregation was the objection of being insufficient, pointing out that the data collection framework and instruments themselves were gender biased. Aan "Engendering Statistical System" was called for, carrying a more systematic approach for identifying gender issues, needs and priorities, mainly in the area of economic statistics (Corner, 2003). Differences between women and men were thereby requested to be incorporated into data processes at every level, from data definition and collection to data presentation and analysis, in order to define and construct gender-sensitive indicators.

So far, some of the recommended improvements in the quality of gender data have become, to a certain extent, current statistical practice. Yet, the debate on data collection and presentation seems to be feebly counterbalanced by an analogous review of the methodology for analysing gender data. To this regard, some shortfalls start to come into view from both the methodological and the applicative standpoint, first of all the lack of a statistical framework for processing gender data. In other words, statistical methods need to be explicitly re-assessed in a gender-sensitive outlook, just as it occurs in fields such as health, welfare and the alike, where they are openly adapted and tuned to the nature of specific phenomena,

Composite indicators as a tool for gender differences

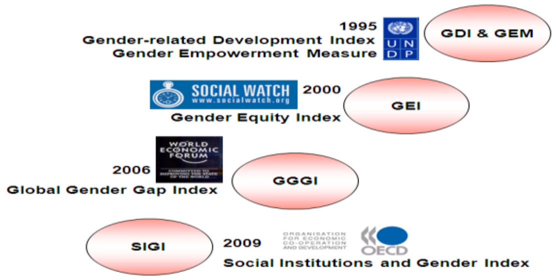
Understanding Genders Statistics unavoidably sets off from a comparison of the principal gender composite indicators supplied by international agencies and offices. An overview of current methods for measuring gender equity and producing world ranking, hits with a major remark: the leitmotif is essentially the -usually rough- use of linear combinations of simple, mono-dimensional indicators, *i.e.* undeniably basic statistical tools such as ratio and proportion.

This especially applies since that international comparisons should take into account the lack of data regarding developing countries. Let us take as an example one of the earlier gender indicators, the Gender-related Development Index (GDI), a version of the Human Development Index (HDI), *corrected f*or,, actually rather roughly gender differences. The HDI is a simple arithmetic mean of three normalised sub-dimensions, respectively life expectancy, education and life standard, measured for the overall population in the HDI. Correcting the latter for gender implies in the first place the computation of simple indexes I_F and I_M for each sub-dimension and for each gender, and subsequently the aggregation of the same simple index computed separately for the two genders into a equally distributed index according to the following power mean expression:

$$\sqrt[1-\alpha]{I_F^{1-\alpha} \cdot \%F + I_M^{1-\alpha} \cdot \%M}$$

where α is intended to convey the penalty for gender disparities, the bigger α the heavier the penalty for a specific gender gap, with a typical value of 2 that sets the expression above to the harmonic mean $1/(\%F/I_F + \%M/I_M)$. An immediate remark on this indicators construction involves its weakness in adjusting HDI for gender. More to the point, simple indexes in the GDI linear combination are mere transposition of measures of a construct often far apart gender gap and therefore they are not fully adequate for their purpose. Besides, for some countries single values are obtained as crude estimates of sub-dimensions, losing reliability. Composite indicators have then been specifically conceived for measuring gender differentials in social/work chances and in active participation, , *e.g.* the Gender Empowerment Index (GEI). Once again, their computation consists of a linear combination of the harmonic mean of simple indexes for the two sexes (Fig.1).

Figure 1: Development of composite indicators for gender gap in recent years



Ensuing considerations of these limits have led to statistically more sophisticated analytical measures, as a result of general methodological progresses in global multidimensional indicators. Based on the Gender, Institutions and Development Data Base (GID-DB) by the OECD, the Social Institutions and Gender Index (SIGI) synthesizes several measures computed from the GID-DB, where each measure is normalized, in order to equal the minimum value of 0 for a negligible gender gap whilst 1 for the biggest. A Principal Component Analysis then assigns these measures to 5 sub-dimensions on the basis of the intensity of the statistical association. Finally, the first principal component for a single country is rescaled:

$$\frac{PC_c^1 - PC_b^1}{PC_w^1 - PC_b^1}$$

PC^1 being the first principal component, *c* the generic country being ranked, *b* and *w* respectively the best and the worst country among all the countries under scrutiny. It should be noticed that, whereas the GDI is estimated for both developed and developing countries, provided data availability, SIGI computation is limited to developing, non OCSE countries, namely 102 in 2009.

From a bunch of indicators to a definite statistical field

An in-depth assessment of the existing gender indicators leads to the awareness that a wider and far-reaching review on the statistical methods on the theme is required. In particular, the potentiality of adopting classical statistical tools in Gender Statistics needs to be explored. For instance, it is the case of applying traditional association analysis as a mean of interpreting *gender equity* as *statistical independence* in a data matrix. Or else, it is the case of applying the Gini index by extending the notion of income inequality to the quantitative measure of gender gaps. Both standard and more recent multivariate techniques for evaluating and ranking ordinal data need to be taken into consideration too. For instance, classical Principal Component Analysis is expected to better the ranking by avoiding the many subjective choices involved in the construction of any composite indicator. Non-Linear Principal Component Analysis might potentially improve the measure of gender-equity and differences by allowing a mixed use of variables measured over both ordinal and quantitative scales.
Hence, Gender Statistics looks beyond mere data disaggregation by gender, toward a systematic investigation of whatever study characteristics with the aim of untangling, highlighting, evaluating and understanding gaps and issues based on either gender. In this scientific stance, Gender Statistics, too often confined to a bunch of figures and graphs, stands as a statistical research field on its own.

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Traps and Surprises in Long Time Series. Considerations on Italian Living Standards after Unification.

Miranda Cuffaro and Maria Davì

Abstract
Using Italian time series since 1861, we explore the evolution of living standards of Italian population after the Unification. Furthermore, we investigate the informative capacity of the aforementioned series to discover suitable long-run relationships among the variables to be used for a further modelling. Notwithstanding, the dynamics and the statistical characteristics of series have dramatically changed – both within each time series and among all ones – some interesting results have been drawn on the evolution of Italian living standards.

1 Introduction

In this paper our concern is to measure the living standards or material well-being of people rather than the "performance" of a country in terms of GDP. The concept of well-being is intrinsically based on micro-economic utility theory and involves the living conditions of persons. The material well-being represents the basic condition for improvement in various aspects of social life (i.e. increase of educated people, quality of education, better and wider social infrastructures, better conditions in the labour market and in the wider society, better quality of health conditions, etc.). Obviously, in the long run the material and social aspects of people life affect each other. The material well-being contributes to reach better social conditions through households, firms and the public sector; while good

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social conditions of people in terms, for example, of high levels of health and education raise the productivity of workers, and this, in turn, increases the level of output and disposable income (Cuffaro et al., 2008).
Among the most homogeneous and comparable historical time series supplied by ISTAT (Istat, 1958, 1968, 1986), the time series that could better represent the evolution of standards of living and material well-being have been chosen to reach our aim. In particular, we have used two different series of consumption shares, the *food* share (SF_1) and the *all other goods* share (SO) relating to the period 1861–1955, and the *food* share (SF_2) and the *unnecessary goods* one (SUN) (viz. the expenses for cultural, educational and entertainment activities), for the period 1921–1985. Food and unnecessary consumption shares are considered as two faces of the same coin, viz. the material well-being. Furthermore, we considered the total and animal calories (TC and AC). The calories or protein intake have been used in several studies to model the convergence process among countries (see, e.g. Hobijn and Franses, 2001). These series, if correctly measured could give information on malnutrition or under-nutrition in specific periods of Italian history, and in addition they let catch the evolution of necessary diet for a healthy life. Finally, the real disposable income per capita (INC) have been included. To take into account the improvement of living conditions in terms of better education and health, we considered the total graduates (GRAD) and three infant mortality rates (IDR_1, IDR_2, IDR_3). The preliminary analysis is performed through some standard indicators, like the shares of GDP (GDP_{agr}, GDP_{ind}, GDP_{ser},) and the present population (P).
Going deep into the statistical analysis, we are aware that the use in the same analysis of time series with different dynamics can produce various problems in getting reliable results. In the light of that, by means of well-known and suitable statistical tools, we show how so different can be the data generating processes of a single time series along its long-run path.
In the next Section some descriptive statistics and the results of time series analysis will be presented; summary and conclusions will follow.

2 Empirical analysis

Maintaining a suitable length of series in order to make more significant the analysis, we have split the period into three parts: 1861–1914, 1920–1940 and the period after 1946 until the final year of the various time series, ruling out the years of the two wars. Although another periodicity could be done, according also to Barberi (1961), we follow the above one.
In spite of the different length of time series, a common tendency emerges from the three selected periods (see Table 1). In the first interval, we note a substantial stability as all variables evolve at a very low rate. In the second period, the evolutionary path is more clear, specially for the population and the two shares of consumption, accompanied by a net raising of per capita income. Finally, in the third period all economic variables show higher rates of variation with a strong increase in the INC and SUN; at the same time, the slowdown of the different death rates becomes more evident and the population stabilizes on the annual growth rates near the current ones. In summary, data show living conditions in this last

period received an impulse, especially in terms of material well-being. Moreover, the quality of life became dramatically better as shown by the increase of graduates and the decrease of infant mortality.
Could we extract different information from a more in depth analysis of time series?

Table 1: Characteristics of series over time

Series		Yearly Average Variation %	σ/μ	Yearly Average Variation %	σ/μ	Yearly Average Variation %	σ/μ	Yearly Average Variation %	σ/μ
	Length of Series	1861-1914	1861-1914	1920-1940	1920-1940	1946 - ┤	1946 - ┤	Overall Period	Overall Period
INC	1861-1970	0.580	0.108	1.131	0.064	5.829	0.374	1.530	0.578
TC	1861-1985	0.105	0.106	0.228	0.049	1.524	0.147	0.188	0.134
AC	1861-1985	0.032	0.107	0.313	0.057	2.860	0.327	0.713	0.358
GDP_{agr}	1861-1955	-0.557	0.093	-2.406	0.177	-6.407	0.207	-0.850	0.218
GDP_{ind}	1861-1955	0.394	0.107	0.954	0.117	3.599	0.101	0.888	0.296
GDPser	1861-1955	0.718	0.123	2.239	0.152	4.133	0.103	0.243	0.169
POP	1861-1955	0.962	0.128	1.075	0.056	0.486	0.018	0.848	0.212
GRAD	1926-1985	-	-	3.032	0.272	2.950	0.540	3.830	0.742
SF	1861-1955	0.010	0.051	0.276	0.049	-1.630	0.059	-0.129	0.070
SUN	1861-1955	0.048	0.052	0.144	0.082	2.006	0.070	0.459	0.179
$SF_{\_2}$	1921-1985	-	-	-1.035	0.089	-2.162	0.235	-1.449	0.265
$SUN_{\_2}$	1921-1985	-	-	0.071	0.226	2.867	0.218	1.254	0.355
$IDR_{\_1}$	1926-1985	-	-	-1.831	0.068	-3.775	0.453	-2.949	0.406
$IDR_{\_2}$	1863-1955	-1.129	0.154	-1.042	0.101	-5.762	0.180	-1.633	0.328
$IDR_{\_3}$	1929-1984	-	-	-0.674	0.025	-3.179	0.344	-2.420	0.315

Note: ┤ indicates the end of the period. INC (Real Income per Capita at 1963); TC (Total Calories); AC (Animal Calories); GDP_{agr} (GDP in Agricolture); GDP_{ind} (GDP in Industry); GDP_{ser} (GDP in Service Sector); POP (Present Population); GRAD (Total Graduates); SF (Share of Food Consumptions); SUN (Share of Unnecessary Consumptions); $SF_{\_2}$ (Share of Food Consumptions); $SUN_{\_2}$ (Share of Unnecessary Consumptions); $IDR_{\_1}$ (Still-born per 1000 born); IDR_2 (Dead in the First Year per 1000 born); IDR_1 (Dead in the First Week per 1000 born).

To answer to the question, we focus on INC, TC, AC, SF_2, SUN, GRAD, IDR_2. We examine the dynamics of these series for the entire period, and, if available in the three sub-periods, through some standard statistical tools (i.e. test on normality, Jarque-Bera (JB), test of integration-Augmented Dickey-Fuller (ADF), Phillips-Perron (PP), correlograms, ARMA models, Johansen cointegration test. By the JB test performed on the original series, its absolute values and Δln, we can classify the series in *highly volatile* – to be modelled by an ARCH process – and *not volatile* stationary around the trend or difference stationary. As known, shocks to a stationary time series are necessarily temporary and over time the effects of shocks will dissipate and the series will converge to its long-run mean level. Thus, to test if series exhibits mean reversion (i.e. if it fluctuates around a constant long-run mean) we estimated the following model: $\Delta \ln x_t = \alpha + \beta \ln x_{t-1} + \varepsilon_t$. A significative and negative β indicates the speed by which the series converge towards the equilibrium, viz. if it is *mean reverting* or not.
The results collected in Table 2 show for the overall period the high volatility of INC and AC mostly due to the world wars, but not only. In fact in the period 1861-1914, INC still shows a high volatility. Also SUN, in the period 1920–1940 is highly volatile; while, the other series seem to be I(1) in all periods. But the analysis of β coefficients reveals some surprises; actually, we see TC in all the three sub-periods converges strongly to its unconditional mean, while AC converges to

the mean only in the period 1920–1940. In addition, also SF_2 is not *mean reverting* in the last sub-period, in spite of the indication of ADF test. Among the *mean reverting* series, it is noteworthy the high values of β coefficients for TC in the period 1861–1914 (-0.8), and for INC and AC in the period 1920–1940 (-0.4 and -0.6, respectively). Finally, the series are generated within each sub-period from different ARMA processes. In synthesis, TC, AC and SUN are characterized by a MA process indicating a high random component. Finally, on those series integrated of the same order we performed the cointegration test. In particular, on INC, TC, AC, SF_2, SUN over the period 1920–1970 the trace test indicates at 5% that both AC and INC, on one side, and SF_2 and INC, on the other one, are C(1,1), respectively.

Table 2: Characteristics of dynamics

Series	Overall Period*	1861-1914	1920-1940**	1946 - ┤ **
INC	HV	HV	NV, I(1), …, MR	NV, I(1), …, MR
TC	NV, I(1), MA(1), MR	NV, I(1), AR(1), MR	NV, I(1), …, MR	NV, I(1), …, MR
AC	HV	NV, I(1), MA(2), NMR	NV, I(1), …, MR	NV, I(1),…, NMR
SF_2	NV, I(1), AR(2), NMR	-	NV, I(1), …, MR	NV, I(1),…, NMR
SUN	NV, I(1), MA(1), MR	-	HV	NV, I(1), …, MR
GRAD	NV, I(1), ARMA(0,0), NMR	-	-	NV, I(1),…, NMR
IDR_2	NV, I(1), AR(1), NMR	NV, I(1), MA(2), NMR	NV, …, NMR	NV,…, NMR

Notes: (*) As structural breaks have occurred, ADF or PP tests are biased towards the not rejection of a unit root. (**) The periods are too short to estimate a reliable ARMA model.
HV = Highly Volatile; NV = Not Volatile; MR = Mean Reverting; NMR = Not Mean Reverting.

In summary, TC and SUN have a clear *mean reverting* behaviour in all periods, and INC, AC and SF_2 have a moderate attitude to revert to its long-run memory only in the period between the two wars. Indeed, in those years the increasing trend of national income, about which the propaganda of Fascist dictatorship took credit (Lenti, 1961, p.284), determined better living conditions, especially with reference to the sustenance. Specifically, income levels allowed growing animal calorie intake and an ever-increasing share of food. In the post-war period, the diet of Italians became more varied and well-balanced and the *unnecessary* consumptions, granted by higher levels of real income, prevailed in maintaining the convergence of living standards.

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The agricultural sector in the business register: administrative input sources and methodology for determining variables

Salvatore Cusimano[1]

Abstract After a brief description of the theoretical and regulatory framework, we describe the process that led to the identification of agricultural enterprises and methods used to estimate the main characters (employees and turnover). The process of identification uses two "specific sources", QDFW model for agricultural workers and VAT model for the turnover, in combination with "generic sources", used for the Business register (ASIA) process. The integration leads to estimate enterprises' main attributes: employment – in its components: self employment and employees – and turnover. The process faced problems of transforming variables used for administrative purposes to variables used for statistical purposes.

Key words: agricultural enterprise, administrative input sources, integration process, employees, turnover, Business register

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1 Theoretical and regulatory framework

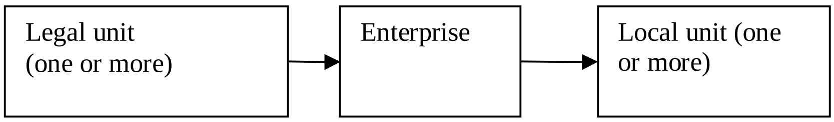
Regulation (EC) No. 177/2008 extends the coverage of the ‘business register’ to enterprises operating in sectors A and B - agriculture, forestry and fishing - NACE Rev. 1.1.

Agricultural activity shows peculiarities that make it not comparable to other types of activities, in particular:

- it is subject to variability than the others on the weather – morphology
- it is subject to the presence of significant benefits that come from various institutions
- is always more difficult to establish the ‘line’ between this type of activity and the industrial activity

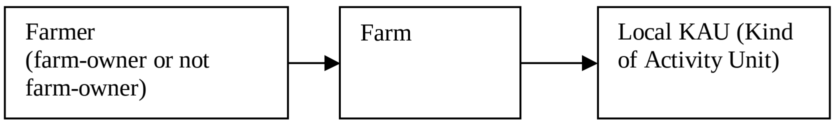
For an enterprise that belongs to the industrial sector, the logical scheme is as follows:

Scheme 1: logical scheme for industrial entreprise



For an enterprise in the agricultural the scheme is as follows:

Scheme 2: logical scheme for agricultural entreprise



2 The process of identification of 'Agricultural enterprise'

The agricultural enterprise is identified as an active unit, an unit that plays an effective production activity in the reference year and uses labor input, whose production is part of the agricultural sector. Unit may be considered agricultural if it declares a turnover through VAT (Valued Added Tax) model, turnover is the result of agricultural production and /or it is registered in the archive of social security of farms with agricultural employees (National Social Security Archive (NSSA), Archive Quarterly Declaration Farm Workers (QDFM)).

The mentioned administrative input sources, which henceforth will be called 'specific sources' in order to distinguish them from the 'generic' ones used to build the Business Register (called ASIA), have their own definitions and their characteristics useful for their purposes. They are summarized in the following scheme

Scheme 3: Administrative input sources: input file, observation unit, number records (initial and final), work performed, unit of analysis

INPUT FILE	OBSERVATION UNIT	NUMBER RECORDS	WORK PERFORMED	UNIT OF ANALYSIS	NUMBER RECORDS
VAT **(Valued Added Tax)**	**PERSONS, NATURAL OR LEGAL, REQUIRED THE MAKING OF THE PAYMENT OF TAXES**	App. 5 millions	**RECONCILIATION OF RECORDS TO A SINGLE TAX CODE, INCLUDE THEIR DECLARATIONS OF ECONOMIC ACTIVITIES**	**UNITS CARRYING OUT AT LEAST AN AGRICULTURAL ACTIVITY (PRIMARY OR SECONDARY)**	App. 480 thousands
NSS – QDFW (National Social Security Archive - Quarterly Declaration Farm Workers).	**FARMS WITH AGRICULTURAL WORKERS, SHALL TO DECLARE ON QDFW**	App. 650 thousands (FARM FILE) App. 8 millions (WORKERS FILE)	**RECONCILIATION OF RECORDS TO A SINGLE TAX CODE, INCLUDING THEIR WORKERS FISCAL CODE**	**FARM WITH AGRICULTURAL EMPLOYEES**	App.205 thousands
NSS – SE **(National Social Security Archive – Self –employemnt Declaration)**	**AGRICULTURAL SELF EMPLOYED WORKERS (FARMERS AND FARMERS PROFESSIONAL, FP)**	App. 480 thousands (FARMERS FILE) App. 20 thousands (FARMERS PROFESSIONAL)	**RECONCILIATION OF RECORDS TO A SINGLE TAX CODE, INCLUDING THEIR FAMILY WORKERS FISCAL CODE**	**SELF EMPLOYED WORKER, WITH OR WITHOUT FAMILY WORKERS**	App. 370 thousands

As shown in the scheme 3, preliminary operations to the integration, for each source, led to the identification of a single fiscal code, with all the variables of interest, in order to avoid duplication typical of each source. We arrive, through this operations, a final number of records more manageable for statistical integration (eg: the VAT, it starts from approximately 5 millions records and we get to approximately 480 thousands records).

The integration process of generic sources was made through the fiscal code; for the reference year 2008, this process led to the identification of the legal basis consisting of all firms in Asia (the Italian Business Register, approximately 4 millions units).

Trough this specific sources mentioned above (scheme 3), we arrive to first step of the identification of agricultural enterprises.

In order to improve the criteria for the identification of 'agricultural units', some rules of exclusion / inclusion have been adopted, rules based on the results of further analysis done by using information taken from the specific sources:

a) exclusion, based on:

- legal form
- absence of turnover and absence of declarations at agricultural NSS self – employed without turnover

b) inclusion:

- units in ASIA and other units, which are signs of agricultural type (presence of agricultural employees and / or statement of non-zero agricultural turnover)

This brings us to a set of agricultural enterprises, consisting of approximately 500 thousands units .

The set thus formed was 'validated' with the list of farms built as support the Census of Agriculture, consisting of approximately 2,8 milion units. The result of all these rules, analysis and validationd led to the identification of approximately 490 thousands units, called 'Asia Agricultural Enterprises Enlarged' (A.I.A.L.), that contains units with agricultural activity, primary or secondary. Ascolta

3 Methodology used to estimate the main characters

The methodology for the allocation of employees is based on the use of joint information in the files and DM10 model (model of National Social Security Institute for workers in industrial sector) on one side and QDFW model (mentioned above) on the other hand, the establishment of an ad-hoc is necessary because the use of these archives could result of duplications or omissions. In fact, based on the Social Security legislation, enterprises operating in the agriculture sector should use the DM10 model for a particular category of workers' contributions and the NSS – QDFW model (with a difference between fixed workers -OTD and permanently workers -OTI); for a particular category of the latter, OTI, enterprises must pay contributions to the QDFW model and some others to the DM10 model, all under the rules of L. 240/1984. Consequently, for the purposes of the imposition of employees can not simply make the sum of the values of employees declared in two files.

In this case, we need help us another administrative source, E-mens (that resumes informations of another NSS administrative source, Montante), that contains more detailed informations on workers.

For the components "self employment", it was considered appropriate to separate the estimation process:

- in the case of 'ASIA units' and 'other units', the independents are those estimated in the process of 'ASIA'

- in the case of ‘Asia agricultural enterprises’, the independents are those declared to the source 'self – employed' (NSS - SE), in the presence of this source; in the absence of the source are set equal to 1.

It is clear we have a large percentage of independent set equal to 1, for which they are studying in various groped for a "killing", for make them more consistent with the estimates of other Official Statistics.

As regards the turnover, defined as the total amount resulting from the sale of goods and services in the reference year, it comes from the turnover declared in the annual VAT declaration models of the Revenue - valid with appropriate statistical procedures for checking and correcting data. With respect to any unit of A.I.A.L., we proceeded to imputation of missing values or no turnover. The value to be imputed was obtained by multiplying the average turnover per employee, estimated on the basis of non-zero values of turnover and whereas the sector of economic activity, for the number of employees. The allocation has affected nearly 40 thousands subjects, about 8% of the approximately 490 thousands units of AIAL, have a turnover of 4%, then the charge is modest.

4 Conclusions

The identification of enterprise is more easy through the combination of several sources, even if the huge amount of data it is clear that he needs time and significant resources to be better handled and used.

However, greater “collaboration” with the part 'physical' statistical register of farms can be a good basis not only for the Census of Agriculture, but also to better resolve doubts as to those units in a 'grey zone' as to the nature of the activity.

As regards employment, we are studying procedures that use coefficients (hours or days of theoretical work necessary for the type of production) that enable us to better estimate the employment , in its component “self employment”.

With regard to the turnover, there is the problem of the presence of enterprises that declare an agricultural activity and, conversely, perform non-agricultural activity; this problem can be resolved only by control at the micro level, which certainly require more human resources.

Another administrative source, Agea, governed by Regulation (EC) No. 1782/2003, that governs procedures for payment of contributions to agricultural producers, is very helpful to be able to give confirmation on the 'goodness' of the final list of enterprises of Asia, meaning that if the units on the list require contributions AGEA is a confirmation that it is unity with agricultural activities.

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Regolamento (CE) N. 177/2008 del Parlamento Europeo e del Consiglio, che istituisce un quadro comune per i registri di imprese utilizzati a fini statistici e abroga il regolamento (CEE) n. 2186/93 del Consiglio

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Gender EmancipA(c)tion (1945-2011)
- An Italian History through Women's Eyes -

Daria Squillante, Alessandra Federici [1]

Abstract During the last 66 years of Italian History (1945-2011) women have been experimenting an extraordinary deep (r)evolution, consisting on the empowerment of consciousness, gender cultures/studies and political practices, to conquer a different and respected "core position" in the society: moving from material conditions of life and symbolic roles traditionally considered both "natural" and "motionless", towards the convinced and passionate request of a social and symbolic identity connoted by a new organization of public/private gender balances, civil rights and relationships. Firstly the ardent Feminine Movements for Resistance during the WWII and for the Suffrage battle, and secondly the feminist movement fighting for legal, labour, public/private cultural equality, all represent extraordinary phases of social and personal *gender renewals*, tended to redefine "gender differences" not in terms of "power asymmetries" - as in a patriarchal culture of domination - but in terms of "different eyes and hands" together fundamental, *since* their difference, for a new way of managing public/private relationships between genders and building a better society. Narrations as well as statistics about the multidimensional aspects of the Italian society tells this story of a "Gender EmancipA(c)tion".

1 66 anni (1945-2011): la soglia della *giovinezza storica* delle Donne

Se 66 anni identificano generalmente il limitare demografico, statistico, antropologico dell'anzianità e dell'uscita dal mercato del lavoro e da una canonica ed ufficiale "produttività" in senso lato - obbligando tanto personali quanto scientifici ricollocamenti identitari e socio-economici di ciascuna donna e ciascun uomo - "66 anni (1945-2011)" di percorso politico, economico, sociale, culturale italiano hanno fondato l'ingresso nella "giovinezza" storica - ritardata, sofferta e tuttora sostanzialmente incompleta - di una *partecipazione protagonista femminile*: se non nella sufficienza delle conquiste pubbliche e private raggiunte, certamente nell'identificazione e nel perseguimento *autodeterminato e autosignificato* di uno *status* giuridico, sociale, economico, filosofico, simbolico che riconoscesse e consegnasse alle donne una *centralità* individuale e collettiva che corresse speditamente *oltre* la semplice *emancipazione* da un immobilismo privato e pubblico - nella permanenza però di/in un ordine materiale e simbolico preesistente e maschile - verso la progressiva elaborazione di nuove forme simboliche e di una diversa organizzazione delle relazioni tra i sessi. Il tenace impegno femminile durante gli anni della guerra; il fronte orgoglioso delle partigiane nella Resistenza (ben 35.000 donne, di cui almeno 2.750 fucilate e 15 insignite della medaglia d'oro); le battagliere *suffragette* per il diritto al voto alle donne; la sorprendente intelaiatura costituzionale nella formulazione di più articoli fondativi della parità di genere[2]; gli smottamenti a quelle (apparentemente!) incrollabili stratificazioni giuridiche - si pensi al divorzio, all'aborto, alla rigenerazione del diritto di famiglia, alla legge sulla violenza sessuale - che costringevano le donne all'angolo di posizionamenti marginali - *erga omnes* e *intra domus* - ritenuti "naturali" e caratterizzanti il genere femminile stesso come subalterno e al servizio di quello maschile; il desiderio e la sua pretesa di partecipare nuclearmente al mercato del lavoro, rappresentano tanti *compleanni* verso la maturità di un nuovo ordine materiale e simbolico che consenta alle donne uno *scarto* di pratica e di significato nella costruzione tanto di un ordine sociale, politico, economico e filosofico quanto della gestione dei poteri che lo regolano condiviso fra i generi. La *differenza* femminile perde dunque progressivamente il suo essere *priva di storia*, nel senso del suo essere vissuta ed interpretata con *immobilità* stante la sua posizione già (eternamente) *data* e *detta* dal genere maschile. Così l'essere agenti

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2 Sull'opportunità tanto teorico-politica quanto della pratica della *parità* e delle *pari opportunità* molte posizioni favorevoli e contrarie sarebbero da riportare e confrontare. Non può essere purtroppo questa la sede, e si intenda pertanto l'adozione di questa terminologia come scelta di più facile "agibilità" e non necessariamente di condivisione da parte di chi scrive.

attive[3] della storia, grazie alla *Parola* conquistata nella politica ufficiale e nei luoghi delle donne, come all'ingresso sempre più importante e variegato nel mercato del lavoro, solleva una vera e propria *questione identitaria femminile*, chiamando tutti i diversi attori del sistema (stato, chiesa, partiti, sindacati, famiglie e associazioni) a rispondere aderendo e favorendo (si pensi alle già ricordate transizioni legislative) o opponendosi e resistendo (si pensi alle diverse forme di repressione sociale; ai soffitti di cristallo e alle porte senza serratura del mercato del lavoro, nonché alle farraginosità degli *iter* parlamentari per ostacolare l'approvazione di "leggi scandalo", come quelle sull'aborto o sulla violenza sessuale) al moto (perpetuo) della *rivoluzione di genere*.

2 Polveriera donna: il tramonto dell' "incapacità giuridica" di genere (1945-1975)

Il 1945 aveva appena cominciato a prendere forma, quando un decreto legge istituì "l'estensione alle donne del diritto di voto" (d.lgt. 1945): nell'espugnazione di uno dei più indifendibili monopoli maschili, se impareggiabile fu l'incisività dell'ordine del giorno del primo congresso della CGIL unitaria a Napoli (28 gennaio - 1 febbraio 1945) che sigillava la "maturità sufficiente" delle donne per il voto con la constatazione dalla loro eroica opera di respingimento del nazifascismo, decisiva fu la battaglia del *Comitato promotore per il voto alle donne*, che annoverava fra le sue schiere le rappresentanti femminili del Comitato di Liberazione Nazionale (CLN). E mai primavera fu più tale di quella del 1946: le amministrative furono il preludio al voto del 2 giugno 1946, in cui le donne (12 milioni su 22 milioni di elettori/rici) non solo votano ma sono votate in 21 per la nascitura Costituente. Ed emblematiche per i rivolgimenti sistemici che innescheranno negli anni a venire saranno le accese *quérelles* per l'inserimento nel dettato costituzionale di articoli come il 37 (parità salariale) e il 51 (accesso delle donne a tutte le carriere), che si palesavano come proponimenti "sovversivi" della "funzione familiare prevalente, connaturata e prioritaria" delle donne - per dirla con le parole dei detrattori degli articoli in questione. Ma furono poi altrettanto "sovversive" le propagande elettorali delle donne nella campagna del 1946? Non era ancora il tempo, in effetti. Così sia le candidate DC che quelle comuniste avvertirono che nel Paese vi era desiderio di una ritrovata tranquillità post-bellica che passava inconsciamente anche per la riconduzione della donna nell'alveo familiare: la partecipazione femminile all'agone politico poteva dunque giustificarsi soltanto nel proporsi come un prolungamento di *maternage* e di altruismo consustanziale all'essere donna. Tuttavia, l'afflato antiburocratico e l'energia del rinnovamento che permeavano l'Italia all'indomani di un conflitto che aveva sobillato ogni esitazione democratica incendiarono per tutto il decennio '50-'60 gli animi femminili sul diritto al lavoro e le sperequazioni salariali[4]. Torino (1945) ricorda ancora lo sciopero in cui 10.000 donne minacciarono di lanciare il prefetto dalla finestra, come importante fu la vittoria degli accordi interconfederali del 1945-1946 che adeguarono i livelli salari femminili a quelli maschili, pur conservando una differenza media del 30% per la busta paga e del 13% per l'indennità di contingenza. Il 1949 non fu certo anno quieto, partorendo già solo nei primi mesi 127 agitazioni di donne nel settore tessile, fra scioperi e occupazioni di fabbriche, in parallelo alle lotte delle mezzadre e delle coadiuvanti per l'abolizione delle regalie e delle servitù e per migliorare la struttura della loro vita (istruzione, acqua e beni primari, assistenza ostetrica e farmaceutica, abitazioni decorose). Appassionatamente acclamata arriva così infine nel 1950 la combattutissima *legge sulla tutela delle lavoratrici* (una delle migliori leggi di maternità fra i paesi capitalistici di allora) che congela il posto di lavoro della gestante e le garantisce l'80% della retribuzione nei quattro mesi di riposo obbligatorio. Ma è ancora pochissimo per le donne di partito, dei movimenti e degli associazionismi femminili della società civile, che credono caparbiamente in un cammino di riscatto delle donne: così nel 1958 UDI, ACLI e CIF formano un fronte comune che le premia con l'approvazione della prima legge nazionale sul *lavoro a domicilio,* perché venga tutelato al pari di quello subordinato (cfr. Tavola 1). Nondimeno, la crisi economica del '63-'64 smotterà in maniera drastica e quasi irreversibile le fondamenta della partecipazione delle donne al mercato del lavoro, espellendole dal settore agricolo, industriale e terziario (cfr. Tavola 1).

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3 La differenza fra l'essere *attrici* o *agenti* della storia rappresenta interessantissima questione e disputa filosofica e politica negli studi femminili e femministi di genere. Si veda ad es. Diotima, *La Sapienza di Partire da Sé,* La Tartaruga, 1990.

4 Si pensi al cosiddetto coefficiente Serpieri", che abolito soltanto nel 1964 valutava il lavoro contadino femminile allo 0,60 di quello maschile.

Tavola 1: Popolazione presente in Italia per condizione, posizione nella professione, settore di attività economica e sesso (%). Fonte: Rilevazione campionaria ISTAT Forze Lavoro

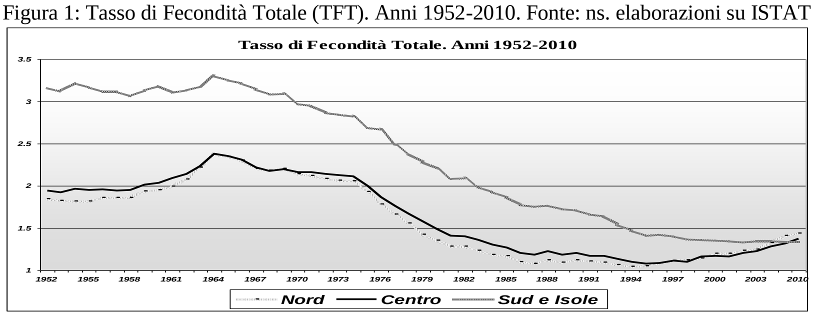
	Forze di lavoro									
	Agricoltura		**Industria**		**Altre Attività**		**In cerca di Occupazione**		**Non Forze di Lavoro**	
	M	**F**	**M**	**F**	**M**	**F**	**M**	**F**	**M**	**F**
1960	18.47	8.61	23.35	7.25	17.36	8.12	2.53	0.92	38.29	75.09
1962	15.81	7.90	24.99	7.15	17.62	8.27	1.70	0.79	39.88	75.88
1964	13.49	6.28	25.49	6.56	18.20	8.17	1.53	0.67	41.29	78.32
1966	12.81	5.31	24.01	5.89	17.84	7.87	2.20	0.80	43.15	80.13
1968	11.31	4.89	24.48	5.95	18.41	8.10	1.84	0.82	43.96	80.25
1970	9.72	4.12	25.06	6.19	18.39	8.26	1.56	0.77	45.26	80.67
1972	8.71	3.73	24.77	5.72	18.04	8.33	1.79	0.83	46.68	81.38
1975	7.46	3.43	24.73	5.95	18.98	9.37	1.48	0.91	47.34	80.34

Il primo ventennio del dopoguerra scatena anche dibattiti e richieste in tema di sessualità, dalla contraccezione alla richiesta di consultori, financo alla tragedia dell'abortività clandestina; dalla regolamentazione della prostituzione (Legge Merlin) alla fecondazione artificiale e alla procreazione "illegittima". Tuttavia, l'istinto creatore e amazzone femminile si rilancia continuamente per generare nuove richieste politiche e sociali: così nel 1970 le donne festeggiano il travagliato iter legislativo sul divorzio, legge confermata nel 1974 dal voto popolare con il 59% di voti a favore, che fa da volano motore alla stesura e all'approvazione, nel 1975, del nuovo diritto di famiglia: la parità tra coniugi; la reciprocità di diritti e doveri nei confronti dei figli e della gestione della casa; la parificazione dei/delle figli/e nati/e fuori dal matrimonio siglano il tramonto dell'"incapacità giuridica" - o quantomeno di una sua opacità applicativa - delle donne. E il 1975 è anche l'anno dell'istituzione dei - seppur di compromesso - consultori pubblici.

3 "La decisione alla Donna" (1976-1995)

E ora l'aborto. Non era più tempo di subire i farraginosi patteggiamenti parlamentari su poco convincenti e convinte proposte di legge. E la parola d'ordine travolgente del corteo convergente *UDI-Gruppi Femministi* del 3 aprile 1976 - "La decisione alla donna" - testimonia di una consapevole e complessa mobilitazione unitaria sulla sessualità, che porterà anche alla promulgazione della legge sull'aborto nel 1978, e all'accelerazione di un ricollocamento dinamico ed incessante, personale e collettivo, in tema di fecondità (cfr. Figura 1).

Figura 1: Tasso di Fecondità Totale (TFT). Anni 1952-2010. Fonte: ns. elaborazioni su ISTAT



Ma il 1978 è anno a cavallo del biennio "di piombo" 1977-1979: e la morte di Giorgiana Masi dimostrò come anche l'universo della protesta e della politica femminile non fosse risparmiato dalla tragica spirale violenza-repressione-violenza. Ma il femminismo è ormai "diffuso": e seppure in una rivoluzione "silenziosa" con andamento carsico, le donne operano nei sotterranei delle loro individualità e dei luoghi politici di confronto collettivo per elaborare e trasferire teoria e pratica di quella *Cultura della Differenza*, quale futuribile fondamento per una riprogettazione del codice e del sistema di convivenza e governo fra generi. E ancora l'istruzione, agguerritamente: e se così nel 1971 le donne diplomate sono il 6,2% e quelle laureate solo l'1,1%, nel 1981 le donne diplomate raggiungono il 10,8% e le laureate il 2,1% (cfr. Tavola 2), favorendo altresì alcune nomine di eccellenza - a dire il vero infrequenti - come quella di Ada Grecchi alla vicedirezione dell'ENEL (1991), di Letizia Moratti alla presidenza della RAI (1994) e di Elena Paciotti alla presidenza dell'Associazione Nazionale Magistrati/e (1994-1999), chiudendo un ventennio che già rinnovava vecchie e nuove insoddisfazioni.

Tavola 2: Italia**.** Popolazione residente 6+ anni per grado di istruzione e sesso. Fonte: Censimenti della Popolazione anni 1951, 1961, 1971, 1981 (%).

Titoli di Studio	Maschi				Femmine			
	1951	1961	1971	1981	1951	1961	1971	1981
Laureati/e	1.6	2.1	2.6	3.6	0.4	0.6	1.1	2.1
Diplomati/e	3.8	4.8	7.7	12.2	2.8	3.7	6.2	10.8
Scuola media inferiore	7.0	11.2	16.6	26.5	4.9	8.1	12.8	21.3
Scuola elementare		43.8	44.4	39.2		40.9	44.1	41.9
Alfabeti/e senza titolo	77.1	31.6	24.7	16.3	76.7	36.7	29.5	20.0
Analfabeti/e	10.5	6.5	4.0	2.2	15.2	10.0	6.3	3.9
Totale	100	100	100	100	100	100	100	100

4 L'(in)compiuto *empowerment* di genere (1995-2011)

La IV Conferenza Mondiale delle Nazioni Unite sulle Donne (Pechino, 1995) marchia a fuoco il decennio, attraversandolo con la sua *Beijing Declaration and Platform for Action for Equality, Development and Peace (PfA)* - piattaforma rilanciata a cinque, dieci, quindici anni - che invoca fortemente l'*empowerment* delle donne per una costruzione socio-politica ed economica globalmente sostenibile e vincente. Nel frattempo nel 1996 viene approvata la legge sulla violenza sessuale - dopo un *iter* culturale e politico di ben 17 anni -. E se erano ormai 20.000 nel 2000 (ex Legge Spini), le donne presenti nelle forze dell'ordine e nell'Arma dei Carabinieri[5], la Legge 40 del 2004 sulla procreazione assistita, come i continui attacchi alla Legge 194 e alla sperimentazione della pillola RU 486, ricordano come le conquiste delle donne non siano mai né complete né tantomeno "al sicuro". Così la crisi economico-finanziaria detonata nel 2008; la precarizzazione, il ridimensionamento e l'espulsione dal mercato del lavoro; la difficoltà attuativa del "*doppio sì*" delle donne - alla partecipazione economica e alla scelta della riproduzione -; la sottorapresentanza di genere negli organismi di vertice politici ed economici pubblici/privati[6]; la continua violenza culturale che reifica il corpo e la mente delle donne, negando loro la *soggettività* del comunicarsi, rappresentarsi ed agirsi *oltre* l'ordine simbolico e materiale proposto-imposto dagli uomini, affidano alle donne - e agli uomini consapevoli della imprescindibilità e della giustezza dell'*empowerment* femminile - l'impegno e la passione di procedere per la realizzazione di un sempre più compiuto *sistema della differenza*.

Tavola 3: Tassi di occupazione, di disoccupazione e di inattività per sesso. Anni 2005, 2007 e 2009. Fonte: ns. elaborazioni su dati I.STAT

Territorio/sesso			Tasso di occupazione			Tasso di disoccupazione			Tasso di inattività		
			2005	2007	2009	2005	2007	2009	2005	2007	2009
Italia		**M**	69,72	70,70	68,63	6,16	4,89	6,76	25,62	25,60	26,29
		F	45,27	46,63	46,36	10,05	7,88	9,28	49,64	49,35	48,86
		T	57,48	58,66	57,48	7,72	6,09	7,79	37,64	37,48	37,60
Italia	**Nord**	**M**	75,12	76,26	74,54	3,03	2,60	4,49	22,50	21,65	21,87
		F	55,12	56,84	56,50	5,84	4,71	6,42	41,44	40,32	39,60
		T	65,22	66,66	65,60	4,21	3,50	5,32	31,88	30,89	30,66
	NO	**M**	74,65	75,38	74,11	3,19	2,99	4,99	22,84	22,25	21,91
		F	54,47	56,38	55,91	6,04	4,85	6,86	42,01	40,73	39,95
		T	64,64	65,96	65,09	4,39	3,78	5,79	32,35	31,40	30,86
	NE	**M**	75,77	77,50	75,14	2,80	2,08	3,81	22,01	20,83	21,83
		F	56,05	57,50	57,31	5,56	4,52	5,83	40,63	39,76	39,11
		T	66,03	67,62	66,31	3,97	3,11	4,67	31,21	30,18	30,39
	Centro	**M**	71,38	72,98	72,12	4,95	3,89	5,75	24,84	24,00	23,38
		F	50,81	51,82	51,96	8,31	7,16	9,21	44,54	44,15	42,73
		T	60,99	62,31	61,94	6,38	5,28	7,24	34,79	34,17	33,15
	Sud	**M**	61,89	62,25	58,99	11,38	8,92	10,94	30,06	31,58	33,67
		F	30,09	31,12	30,57	19,60	14,92	15,34	62,52	63,39	63,85
		T	45,84	46,54	44,63	14,27	11,03	12,51	46,44	47,63	48,92

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[5] Si sottolinea in questo senso l'importanza della *libertà di scelta*, non del contenuto della scelta.

[6] O il suo simulacro, quando è la componente maschile a designare quella femminile.

How to increase statistical literacy in primary schools: the proposal of Istat in Tuscany*

Silvia Da Valle and Alessandro Valentini

Abstract In the last years Italian institutions are paying more and more attention to the growing of statistical culture with particular care to young generations. An example is represented by National Indications for *curricula* for the primary school, which make a specific reference to the acquisition of knowledge and abilities in statistics (i.e. managing statistical instruments like tables and graphs). Another signal comes from INVALSI[1], the institute voted to evaluate the quality of Italian instruction system. The institute introduced a specific set of questions in the area of statistics (named "data and previsions") in the usual annual survey for the measurement of learning in mathematics of primary school students (2nd and 5th classes). Scope of the present paper is to illustrate the specific action plan organised in this framework by Istat - office for Tuscany - to support teachers in their statistical dissemination work with pupils. The idea is to offer to teachers new interactive working tools to use with children for a different approach to learning: friendly presentations of main topics, simple exercises, new way of representing statistical information. The opportunity to have results of the tests back to each school from INVALSI give also the chance to evaluate the goodness of the method by comparing answers between classes that used the proposal and classed that do not.

1 Introduction: the cultural and institutional context

Scientific society, institutions, media, agree on the assertion that statistics plays an important role in actual cultural context. This leading position is due to the "key role" of statistics in quantitative information that literally invade our everyday life [1].

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1 Istituto nazionale per la valutazione del sistema di istruzione

Not by chance recently *The Economist* introduced the expression “data deluge” to describe how much quantitative information is soaring and how statistical data can influence public opinion [6].

In this framework it is strategically important to have not only basic knowledge, but solid skills to “spot patterns and extract useful information” from rising and rising amount of data [7].

According with the described scenario, Italian institutions are paying more and more attention to the growing of statistical culture, with particular care to young generations.

Institutions like MIUR[2] demonstrated sensitivity to the problem of increasing statistical literacy - already from the first classes of the compulsory education - and organized the National Indications for *curricula* for the primary school [5] introducing a particular attention to the acquisition of skills in statistics (i.e. managing tables and graphs and extracting information from them).

The ability to manage statistical data is also one of the topics treated by INVALSI, the institute voted to evaluate the overall quality of Italian educational system. According to its mandate the institute has the task of verifying skills and knowledge of Italian students in various area. For this purpose, since 2006-2007 INVALSI every year realizes a survey for the measurement of learning in mathematics of pupils in 2nd and 5th classes of primary schools. From the school year 2008-2009 such survey became a census survey [2].

The survey is carried out with a written test for the pupils and it is organized in multiple-choice questions or open-ended questions on various items; a group of them is specifically dedicated to statistics and it is named “data and previsions” [3].

To give an example, we tabulated below (Table 1) the results of the latest survey - for details, see [4] - (school year 2009-2010) to the questions expressly dedicated to statistics in 2nd classes. The table shows the percentage of correct answers of students in Italy and in Tuscany.

The table shows, for statistical questions D10 and D16, a percentage of correct answers below the overall mean without significant differences between Tuscany and the other Italian Regions. These results can be read as signals of difficulty in managing statistical instruments by pupils, also because INVALSI assigned medium-low level of difficulty to questions in Table 1.

Table 1: Distributions of correct answers to the overall test and to the questions in the area “data and previsions” of the pupils in 2nd classes of primary schools at INVALSI’s test. Italy and Tuscany. School year 2009-2010.

Question *(In parentheses the reference to the question in the test)*		***% of correct answers*** (in parentheses % of no answer)			
		Italy		***Tuscany***	
Extracting information from tables	(D10)	23.5	(1.8)	21.8	(1.5)
Managing tables	(D13)	58.5	(4.8)	56.0	(4.9)
Extracting information from graphs	(D16)	47.5	(2.8)	47.5	(3.0)
Overall test		**56.7**		**55.7**	

Source: INVALSI – SNV 2009-2010

[2] Ministero dell’Istruzione, dell’Università e della Ricerca.

2 The action plan developed by Istat in Tuscany

In recent years interesting activities and initiatives have been developed to increase statistical literacy at different levels: Istat, for example, realized "*Il valore dei dati*", a hypertext directed to non-expert users (i.e. students, teachers and anyone with interest in the quantitative approach to knowledge) to help them in the correct use of statistics.

Another example is given by "*Matematica per il cittadino*" an idea developed by MIUR, UMI[3] and SIS, directed to improve the scientific dimension of the culture of citizen, through the definition of a set of basic knowledge and skills necessary for better integration in today's society, to be implemented starting form the school *curricula*.

Taking account of all the principal works already done in this direction and in compliance with its statutory mandate, Istat, office for Tuscany, detected the need for an action, specifically directed to primary schools, to achieve a variety of purposes: increasing statistical literacy of young generations; making statistical information more accessible even for pupils; decreasing the distrust of statistics and increasing the sense of closeness to institutions that deal with statistics.

The idea behind the project is to interact with children through their teachers, offering them innovative working tools for a different approach to learning statistics: friendly presentations of main topics, simple exercises, new way of representing statistical information (i.e. animated graphs).

In details the project is organized in various work steps, briefly described in the list below.

1. *Delivery and illustration of working tools to teachers.* This step is planned in order to provide teachers with the description of instruments and methods.
2. *Dissemination work of teachers with their pupils.* Teachers in this phase have the task to submit to pupils learning tools provided by Istat. In the respect of his autonomy, every teacher can choose best paths for his dissemination work with students.
3. *Evaluation of the goodness of the training project.* The test organized by INVALSI, in 2^{nd} and 5^{th} classes, to evaluate the overall quality of Italian educational system, give us the opportunity to evaluate the goodness of the method. The idea is to use the results of the tests that INVALSI give back to schools to compare answers between classes that used the proposal and classed that do not.

Actually a preliminary experiment of the whole project includes 6 institutes (half of whom in Tuscany). Globally around 30 classes for a total of 500 pupils involved.

At the end of March 2011 teachers have been contacted for a training course (step 1) during which they received a description of the project and all the details to use working tools delivered. Since then, teachers had the possibility to work with their classes using the materials released by Istat (step 2). The month of May is dedicated to evaluation stage (step 3) comparing the results of a specific test among children in classes that participated to the project and a group of classes of the same institute who did not ("control group"). INVALSI test (submitted on May 13^{th}) will be used for classes 2^{nd} and 5^{th} and a similar test prepared by Istat for classes 3^{rd} and 4^{th}

[3] Unione Matematica Italiana

3 A brief description of contents and tools

Tools provided to teachers are ideated for flexible use with students in various contexts: in a traditional classroom with paper and pen; for individual or group activities, in a computer lab; with interactive whiteboards (so-called LIM).

Material delivered to teachers, is organized in "dossiers": one for each topic. Each dossier is built respecting the same standard: a simple presentation of the topic directed to the students; exercises covering subject described in the presentation; technical brochure for teachers to find metadata, definitions, references about the topic and ideas for further activities with pupils.

Presentations for students are realized with slides using Microsoft Power Point and are partially interactive. Exercises are prepared to be executed both with Microsoft Excel and in a traditional way on paper.

The contents covered are closely related to National Indications for *curricula* for the primary school and are in line with the guidelines for INVALSI's test to ensure the correspondence with the most recent trends in teaching. In the specific, three topics have been treated for the preliminary experimentation: univariate frequency tables, contingency tables and graphical representations: pictograms.

Just to give a brief reference to possible developments of the work, we would like to point out that the project will be extended to a large amount of classes during the next school year. The channel we plan to use to deliver materials to schools may be Istat website, through special agreements with the Regional Education Offices for dissemination of the initiative to interested schools.

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The Concept of Variability in Time Series Analysis

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Abstract The presence of variability in time series analysis has been the source of many stochastic and deterministic models developed for its representation. Using the classical decomposition of a time series, the problem is to find the best estimates of the signal given the observations corrupted by noise. The best estimates are usually defined as minimizing the mean square error. We can observe the variability in the noise component as well as in the signal. The feasibility of the decomposition of a time series was proved in 1938 by Herman Wold, whose theorem provides a justification for autoregressive moving average (ARMA) models and some extensions (ARIMA, RegARIMA). In recent years, the variability of time series models for series observed daily has shown non-linear dependence of the level on previous data points. When dealing with nonlinearities, one should make the distinction between: (1) linear time series where shocks are assumed to be uncorrelated but not necessarily identically independent distributed (iid), and (2) nonlinear time series where shocks are assumed to be iid, but there is a nonlinear function relating the observed time series and the underlying shocks. Among the most applied non-linear time series models are those representing changes of variance along time (heteroskedasticity). These models are called autoregressive conditional heteroskedasticity (ARCH) and the collection comprises a wide variety of representation (GARCH, TARCH, EGARCH, FIGARCH, CGARCH, etc). Here changes in variability are related to, or predicted by, recent past values of the observed series. This is in contrast to other possible representations of locally varying variability, where the variability might be modeled as being driven by a separate time-varying process, as in a doubly stochastic model.

1 Introduction

Pragmatic epistemology can be found in early twentieth century approaches, such as logical positivism, conventionalism, and the interpretation of quantum mechanics by Bohr, Heisenberg, Born ,and other physicists. This philosophy still dominates most present work in cognitive science and artificial intelligence. According to pragmatic epistemology, knowledge consists of models that attempt to represent the environment in such a way as to maximally simplify problem-solving. It is assumed that no model can ever hope to capture all relevant information, and even if such a complete model would exist, it would be too complicated to use in any practical way. Therefore we must accept the parallel existence of different models, even though they may seem contradictory. The model which is to be chosen depends on the problems that are to be solved. The basic criterion is that the model should produce correct (or approximate) predictions (which may be tested) or problem-solutions, and be as simple as possible. The pragmatic epistemology does not give a clear answer to the question where knowledge or models come from. There is an implicit assumption that models are built from parts of other models and empirical data on the basis of trial and error complemented with some heuristics or intuition.

The concept of variability is at the essence of the development of statistics pragmatic epistemology. In the particular case of time series to be discussed in this study, one basic assumption is that variability due to time can be present in the signal and/or the noise of the data generating process.

A time series consists of a set of observations ordered in time, on a given phenomenon (target variable), and usually the measurements are equally spaced, e.g. by year, quarter, month, week, day. The most important property of a time series is that the ordered observations are dependent through time, and the nature of this dependence is of interest in itself. Examples of time series are the gross national product, the unemployment rate, or the daily closing value of the Dow Jones index. Time series analysis comprises methods for analyzing time series data in order to extract meaningful statistics and other characteristics of the data. Time series data have a natural temporal ordering. This makes time series analysis distinct from other common data analysis problems, in which there is no natural ordering of the observations (e.g. explaining people's income relative to their education level, where the individuals' data could be entered in any order). Time series analysis is also distinct from spatial data analysis where the observations typically relate to geographical locations (e.g. house prices). A time series model will generally reflect the fact that observations close together in time will be more closely related than observations further apart. In addition, time series models will often make use of the natural one-way ordering of time so that values for a given period will be expressed as deriving in some way from past values, rather than from future values.

Formally, a time series is defined as a set of random variables indexed in time, $\{ X_1, \ldots, X_T \}$. In this regard, an observed time series is denoted by $\{ x_1, \ldots, x_T \}$, where the sub-index indicates the time to which the observation x_t pertains. The first observed value x_1 can be interpreted as the realization of the random variable X_1, which can also be written as $X(t = 1, \omega)$ where ω denotes the event belonging to the sample space. Similarly, x_2 is the realization of X_2 ,and so on. The *T*-dimensional vector of random variable can be characterized by different probability distributions.

A common practice in time series analysis is to assume that the observations are made up of a systematic part, say f(t), plus a random sequence, say e_t. These two components are also called signal and noise using the electronic engineering terminology. They are not directly observable, they are latent variables, and we can have an intuitive idea of what is the impact of time in such process. One notion is that time proceeds progressively in one direction; another is that events which are close together in time should be relatively highly related whereas the opposite may hold for those farther apart. The effect of time in this model can be present only in the systematic component *f(t)* by means of a specific function or sequence of time which is independent of the random component e_t. In such case we can say that the time variability is of deterministic character because the observations are assumed to be independent random deviations from some function of time which represent the systematic part. The latter often includes the trend, cyclical fluctuations and seasonality. This type of time series model is known as classical , regression or error model The term classical comes from the fact that it goes back to the time when Laplace, Gauss, and others developed the least squares theory and methods for use in astronomy and physics. There is no effect of time in the random component which is assumed to follow a white noise process with zero mean, constant variance, and uncorrelated at different points in time. Such models have been appropriate in astronomy where, for example, f(t) represents the coordinates of a certain planet at time *t.* Because telescopes are not perfect and because of atmospheric conditions, the observations often have a small random error but this error does not affect the position at time t as well as later positions of the planet.

There are other time series models where time affects *f(t)* and/ or e_t, and the random component is felt not only at time t but on later observations . For example, in economics, time series models can often be represented by means of an autoregressive integrated moving average process (ARIMA) of the Box and Jenkins (1970) type. These are time series models where the variability is stochastic and is present in both systematic and random parts.

The main goal of this study is to discuss the impact of time variability in the data generating process of a given phenomenon. This is done by introducing different assumptions concerning the impact of time. Section 2 introduces the meaning of variability in time series, section 3 presents time series models of deterministic variability, sections 4 and 5 deal with time series models of stochastic variability, and finally section 6 gives the conclusion.

2 The Meaning of Variability in Time Series

The variability in time series can be seen from the viewpoint of the impact of time on the probability distribution of the data generating process. Two main approaches can be distinguished, deterministic and stochastic. We say there is deterministic variability when the impact of time is only present in the systematic part and represented by mathematical functions of time. The random component is assumed to follow a white noise process with zero mean, constant variance and non auto-correlated through time.

On the other hand, we say there is stochastic variability if the data generating process follows stationary and/or non-stationary stochastic processes.

From an intuitive point of view, a stochastic process is said to be stationary if its probability structure does not change over time. In such case the variability is stochastic but constant in the sense of not been influence by time. Because the probability structure with respect to time is homogeneous, the sample from which the generating process will be identified is more informative. Furthermore, since the generating process is assumed stationary we can identify it from a relative short number of observations.

A stochastic process $\{X_t\}$ is defined as stationary in strict sense if all the joint distribution functions are invariant when the set of time points $t_1, t_2, ..., t_n$ are moved along the time axis. That is,

$$F_{t_1,t_2,...,t_n}(x_1, x_2, ..., x_n) = F_{t_1+\tau, t_2+\tau, ..., t_n+\tau}(x_1, x_2, ..., x_n), \tag{1}$$

$\forall$n, $\forall$(t_1, t_2 ,..., t_n), $\forall\tau$ e $\forall(x_1, x_2, ..., x_n)$.

The distribution functions depend only on their time position but not in their values, implying that all the univariate distribution functions are identical and the bivariate ones depend only on the time lag (t_2 - t_1), and not on the values of t_1 and t_2. Hence, stationarity in strict sense means that if the moments of the process exist, they are not function of time; there is a constant time stochastic variability. A more restrictive case of stationarity is that of second-order stationary or weakly stationary, where only the first two moments are not time dependent, that is, the mean and the variance are constant, and the autocovariance function depends only on the time lag and not on the time origin, that is,

$$E(X_t) = \mu < \infty,\ E(X_t - \mu)^2 = \sigma_X^2 < \infty, E[(X_t - \mu)(X_{t-k} - \mu)] = \gamma(k) < \infty, \tag{2}$$

where $k = 0,1,2,...$ denotes the time lag. In both cases, time does not influence the values of the observations, and hence there is not time variability. One should note that if the first and second order moments are finite in a strictly stationary process, then the process is also stationary of second order. However, the contrary is not true in the sense that a weakly stationary process is not necessarily stationary in a strict sense.

The simplest case of stationary process, the purely random or white noise process $\{a_t\} \sim WN(0, \sigma_a^2)$ defined as,

$$E(a_t) = 0, Var(a_t) = E(a_t^2) = \sigma_a^2 < \infty, Cov(a_t, a_{t-k}) = E(a_t a_{t-k}) = \gamma_k = 0, \tag{3}$$

for all $k \neq 0$, has a homoskedastic variance which is independent of time but if the variance is time dependent then it is called heteroskedastic and ,in that case, it is not longer invariant with respect to time. It represents a nonstationary stochastic variability. The feasibility of the decomposition of a time series was proved in 1938 by Herman Wold who showed that any second-order stationary stochastic process can be decomposed in two mutually uncorrelated processes $\{Z_t\}$ and $\{V_t\}$, such that

$$X_t = Z_t + V_t \tag{4}$$

$\{Z_t\}$ is an infinite moving average $MA(\infty)$ where the a_t are the innovations which follow a white noise (WN) process of zero mean, constant variance σ_a^2 ,and zero auto-covariance . This component is called purely linear component since only one realization of the process is not sufficient to determine future values $Z_{t+\ell}$, $\ell > 0$, without error. The $\{V_t\}$ component can be represented by a convergent infinite combination of sine and cosine functions with stochastic amplitude and phase given by uncorrelated white noise processes. The series $\{V_t\}$ is called the deterministic part because it can be predicted in the future without error from a single realization of the process by means of an infinite linear combination of past values. Wold theorem demonstrates that the property of stationarity is strongly related to that of linearity and provides a justification for autoregressive moving average (ARMA) models.

A non-stationary stochastic process is one where the assumptions needed for stationarity are not satisfied.

The presence of stochastic variability in non-stationary stochastic processes is often found in the mean and/or variance of the process. There is an important class of non-stationary processes that have been extensively studied, namely, the homogeneous non-stationary processes also known as processes with stationary increments. These processes are non-stationary in the mean but by taking difference of a finite order, the process become stationary in the differences, a classical example is the ARIMA model.

Other nonlinear dynamic developments concern stochastic variance models which allow the series variability to change over time. These models aim to capture empirical regularities often found in financial time series, such as leptokurtosis, volatility clustering, and the fact that returns exhibit little or no serial correlation whereas their squares show strong serial dependence .These are called autoregressive conditional heteroskedasticity (ARCH) models and the collection comprises a wide variety of representations, among which, the Generalized ARCH, called GARCH is the best known, Here changes in variability are related to, or predicted by, recent past values of the observed series. This is in contrast to other possible representations of locally varying variability, where the variability might be modeled as being driven by a separate time-varying process, as in a doubly stochastic model.

In recent years, there has been an increasing number of either linear non-Gaussian models or nonlinear models, Gaussian or not, applied to phenomena belonging to finance, natural, and biomedical sciences. This was mainly due to the rapid development of nonlinear time series which drew on deeper aspects of probability theory and more elaborated tools of statistical inference.

Nonlinear stochastic models for time series components with non-Gaussian probability distribution have been rapidly developed during the last decade within a state-space framework. The general framework for handling nonlinear, non Gaussian structures is such that the measurement equation is replaced by the observation conditional density and the transition equation by a Markovian transition density. Another important development is that of dynamic generalized linear models which assume that the observations originate from the exponential family, such as Poisson and binomial for discrete processes, and exponential and gamma distribution for continued processes. The presence of a relative large number of outliers and structural breaks in a time series can be indicative of departure from normality, and methods have been developed where the disturbances of structural models are assumed to follow a heavy tail distribution, eg. the t-distribution with more than 2 degrees of freedom or a mixture of Gaussian distributions. Similar to other sciences, particularly physics and biology, many advances in statistics have been dependent on advances in computer science and technology. The classical tools of scientific knowledge have been observation (experimentation) combined with ideas that elaborated by scientific methods, lead to the building of models and theories. Today, the computer applied to explore large number of scenarios constitute a new type of tool. The use of the computer to simulate alternatives and present the researcher with information about the alternatives is similar to experimentation, except that the results from the experimentation are not real observations, but the outcomes generated from an assumed model. The simulated data are used to evaluate and study the properties and limitations of the model itself.

3 Time Series Models of Deterministic Variability

The first studies on time series were done in the research domain of astronomy where models were built to determine the position of a planet at a given moment of time. The nature of the problems encountered by astronomers led to the building of very simple models which are today known as classical, regression, or error models (Pannekoek, 1961). This kind of regression models assume that the variability introduced by the impact of time only affects the systematic component. It is represented with simple mathematical functions of time, usually polynomials of rather low degree, logistic functions, Gompertz curves, modified exponentials, and sine and cosine functions, these latter to pick up temporal fluctuations to reflect seasonality and business cycles movements(see, among others Dagum and Dagum, 2006).

For example , the most common representation of deterministic variability is by means of polynomial functions. The observed time series is assumed to have a deterministic non-stationary mean, i.e. a mean dependent on time. A classical model is the regression error model where the observed data is treated as the sum of the trend and a random component. Let us write it as,

$$Y_t = T_t + u_t \,, \tag{5}$$

where T_t denotes the trend and u_t is assumed to follow a white noise stationary process. The polynomial trend can be written as

$$T_t = \alpha_0 + \alpha_1 t + + \ldots + \alpha_n t^n \,, \tag{6}$$

where generally $n \leq 3$. The trend is said to be of a deterministic character because the observed series is affected by random shocks which are assumed to be uncorrelated with the systematic part which is the only one affected by time variability.

4 Linear Stochastic Variability

A major class of models with linear stochastic variability is the one that assumes the stochastic process to be second-order stationary including homogeneous linear nonstationary processes where the non-stationarity is in the mean of the process and can be reduced to stationary in the differences of a finite order. Non-parametric models were first developed and used , mainly by actuaries, at the beginning of the 1900's. Their main assumption is that η_t is a stochastic smooth function of time that can be locally approximated by linear filters or smoothers. Different types of linear filters are used depending on the series under question.

One common smoother is the cubic splines originally applied by Whittaker (1923) and Whittaker and Robinson (1924) to smooth mortality tables and what is minimized is a linear combination of fitting and smoothing, such that.

$$\sum_{t=1}^{T} (y_t - f_t)^2 + \mu^2 \sum_{t=k+1}^{T} (\Delta^k f_t)^2 \tag{7}$$

where $\Delta^k f_t$ denotes the k-th order difference of f_t, e. g. $\Delta f_t = f_t - f_{t-1}$, $\Delta^2 f_t = \Delta(\Delta f_t)$, and so on. The smoothing trade-off parameter λ must be appropriately chosen.

Following this direction, Schoenberg (1964) extended Whittaker smoothing method to the fitting of a continuous function to observed data , not necessarily evenly spaced. In this case, the model can be written as

$$y_t = f(x_t) + \varepsilon_t \tag{8}$$

where the unobserved function f is assumed to be "smooth" on the int $\varepsilon_t \sim IID(0,\sigma^2)$ ne observations are at the n points $x_1, x_2, \ldots x_n$. The problem is to find

$$f_\lambda = \min_{f \in C^m} \frac{1}{n} \sum_{t=1}^{n} (y_t - f(x_t))^2 + \lambda \int_a^b \left[f^{(m)}(x) \right]^2 dx \tag{9}$$

where C^m is the class of functions with m continuous derivatives and $\lambda > 0$.

The solution to (9) known as a smoothing spline is unique and given by a univariate natural polynomial (unp) or piecewise polynomial function spline of degree 2m-1 with knots at the data points $x_1, x_2, \ldots x_n$. The smoothing trade-off parameter λ controls the balance between the fit to the data as measured by the residual sum of squares and the smoothness as measured by the integrated squared m-th derivative of the function . When m=2, which is the case of a cubic smoothing spline then the integral of the squared second order derivative $f^{(2)}$ is curvature and a small value for the integral corresponds visually to a smooth curve. As λ→ 0 the solution f_λ tends to the unp spline which interpolates the data, and as λ→ ∞, the solution tends to the polynomial of degree m best fitting the data in the least squares sense. The smoothing trade-off parameter λ is known as hyperparameter in the Bayesian terminology and it has the interpretation of a noise to signal ratio, the larger the λ the smoother the trend-cycle.

There are other locally linear smoothers defined as moving averages and high order kernels mainly used in the context of seasonal adjustment . These form the basis of methods such as Census X-11 (Shiskin et al. 1967), X-11-ARIMA (Dagum 1980 1988), X-12-ARIMA (Findley et al. 1998), and STL (Cleveland et al. 1990).

Non-parametric signal extraction has also been very much applied to estimate jointly the trend-cycle or non-stationary mean of seasonally adjusted time series (see among others Henderson 1916; Macaulay 1931; Gray and Thomson 1996 ; Dagum,1996 , Dagum and Luati 2000). Other recent works on nonparametric trend-cycle estimation were done by Dagum and Bianconcini (2006) where these authors derive a Reproducing kernel Hilbert Space (RKHS) representation of the Henderson (1916) and LOESS (due to Cleveland, 1979) smoothers with particular emphasis on the asymmetric ones applied to most recent observations. A RKHS is a Hilbert space characterized by a kernel that reproduces, via an inner product, every function of the space or, equivalently, a Hilbert space of real valued functions with the property that every point evaluation functional is a bounded linear functional. This Henderson kernel representation enables the construction of a hierarchy of kernels with varying smoothing properties. The asymmetric filters are derived coherently with the corresponding symmetric weights or from a lower or higher order kernel within a hierarchy, if more appropriate. In the particular case of the currently applied asymmetric Henderson and LOESS filters, those obtained by means of the RKHS are shown to have superior properties relative to the classical ones from the view point of signal passing, noise suppression and revisions. In another study, Dagum and Bianconcini (2008) derived two density functions and corresponding orthonormal polynomials to obtain two Reproducing Kernel Hilbert Space representations which give excellent results for filters of short and medium lengths. Theoretical and empirical comparisons of the Henderson third order kernel asymmetric filters were made with the classical ones again showing superior properties of signal passing, noise suppression and revisions. Dagum and Bianconcini (2009, and 2010) provided a common approach for studying several nonparametric estimators used for smoothing functional time series data. Linear filters based on different building assumptions are transformed into kernel functions via reproducing kernel Hilbert spaces. For each estimator, these authors identified a density function or second order kernel, from which a from which a hierarchy of higher order estimators is derived. These are shown to give excellent representations for the currently applied symmetric filters. In particular, they derived equivalent kernels of smoothing splines in Sobolev space and polynomial space. A Sobolev space intuitively, is a Banach space and in some cases a Hilbert space of functions with sufficiently many derivatives for some application domain, and equipped with a norm that measures both the size and smoothness of a function. Sobolev spaces are named after the Russian mathematician Sergei Sobolev. The asymmetric weights are obtained by adapting the kernel functions to the length of the various filters, and a theoretical and empirical comparison is made with the classical estimators used in real time analysis. The former are shown to be superior in terms of signal passing, noise suppression and speed of convergence to the symmetric filter.

On the other hand, signal extraction by means of explicit models arrived much later. Under the assumption that the entire realization of y_t is observed from - ∞ to + ∞ and η_t and e_t are both mutually independent and stationary, Kolmogorov (1939, 1941) and Wiener (1949) independently proved that the minimum mean square estimator of the signal η_t is the conditional mean given the observations $\{ x_t \}$, that is $\eta_t = E(\eta_t \mid x_t, x_{t-1,}, \ldots.)$. This fundamental result was extended by several authors who provided approximate solutions to the linear non-stationary signal extraction, particularly Hannan (1967), Sobel (1967) and Cleveland and Tiao (1976). Finally, Bell (1984) provided exact solutions for the conditional mean and conditional variance of vector η when non-stationarity can be removed by applying differences of a finite order. This author used two alternatives regarding the generation of vectors x, η and e.

Model-based signal extraction was also used in the context of seasonal adjustment where the signal η_t is assumed to follow an ARIMA model plus a regression model for deterministic variability (see e.g. Burman 1980, Gómez and Maravall 1996, Findley et al. 1998). The latter is applied to estimate deterministic components, such as trading-day variations or moving-holiday effects and outliers. Gersch and Kitagawa (1983) and Koopman et al. (1998) also used signal extraction for seasonal adjustment where the signal η_t is assumed to follow a structural time series component model (Harvey 1989) cast in state-space representation. Signal extraction, parametric and non-parametric, is also widely applied for forecasting purposes.

A typical stochastic trend model often used in structural time series modelling, is the so-called random walk with constant drift. In the classical notation this model is

$$\mu_t = \mu_{t-1} + \beta + \xi_t , t = 1,2,...n ; \xi_t \_N(0,\sigma^2_\xi) , \quad (10)$$

$\Delta \mu_t = \beta + \xi_t$, where μ_t denotes the trend, β a constant drift and $\{ \xi_t \}$ is a normal white noise process. Solving the difference equation (10) and assuming $\xi_0 = 0$, we obtain

$$\mu_t = \beta t + \Delta^{-1} \xi_t = \beta t + \Sigma^{\infty}_{j=0} \xi_{t-j} , t = 1,...,n , \quad (11)$$

which show that a random walk with constant drift consists of a linear deterministic trend plus a non-stationary infinite moving average. Another type of stochastic trend belongs to the ARIMA (*p,d,q*) class, where p is the order of the autoregressive polynomial, q is the order of the moving average polynomial and d the order of the finite difference operator $\Delta = (1 - B)$ The backshift operator B is such that $B^n z_t \equiv z_{t-n}$. The ARIMA (p,d,q) model is written as

$$\phi_p(B)(1-B)^d z_t = \theta_q(B) a_t , a_t \sim N(0,\sigma^2_a) , \quad (12)$$

where z_t now denotes the trend, $\phi_p(B)$ the autoregressive polynomial in *B* of order *p*, $\theta_q(B)$ stands for the moving average polynomial in *B* of order *q*, and $\{ a_t \}$ denotes the innovations assumed to follow a normal white noise process. For example, with *p=1, d=2, q=0,* model (12) becomes

$$(1-\phi_1 B)(1-B)^2 z_t = a_t , \quad (13)$$

where z_t now denotes the trend, $\phi_p(B)$ the autoregressive polynomial in *B* of order *p*, $\theta_q(B)$ stands for the moving average polynomial in *B* of order *q*, and $\{ a_t \}$ denotes the innovations assumed to follow a normal white noise process. For example, with I, model (12) becomes

$$(1 - \phi_1 B)(1 - B)^2 z_t = a_t , \quad (14)$$

which means that after applying first order differences twice, the transformed series can be modelled by an autoregressive process of order one.

5 Nonlinear Stochastic Variability

Non-linear stochastic variability is very important in non-stationary processes observed at high frequency,e.g., hourly, daily, weekly. When dealing with nonlinearities, Campbell, Lo, and MacKinlay (1997)make the distinction between:

(1) Linear time series where shocks are assumed to be uncorrelated but not necessarily identically independent distributed (iid), and (2) Nonlinear time series where shocks are assumed to be iid, but there is a nonlinear function relating the observed time series {Xt} and the underlying shocks. Among the most applied non-linear time series models in financial data are those representing changes of variance along time (heteroskedasticity). These models were first introduced by Engle in 1982 and called autoregressive conditional heteroskedasticity (ARCH) . Here changes in variability are related to, or predicted by, recent past values of the observed series. This is in contrast to other possible representations of locally varying variability, where the variability might be modeled as being driven by a separate time-varying process, as in a doubly stochastic model. Autoregressive Conditional Heteroskedasticity (ARCH) models are employed commonly in modeling financial time series that exhibit time-varying volatility clustering, i.e. periods of swings followed by periods of relative calm. If instead of an AR model, an ARMA is assumed for the error variance, then the Generalized Autoregressive Conditional Heterokedasticity (GARCH) model is introduced (Bollerslev, 1996). The Nonlinear GARCH (NGARCH) also known as Nonlinear Asymmetric GARCH(1,1) (NAGARCH) was introduced by Engle and Ng in 1993. Another type of nonlinear time series models are the Self-Exciting Threshold AutoRegressive (SETAR) models introduced in a seminal paper by Tong and Lim (1980). They are typically applied as an extension of autoregressive models, in order to allow for higher degree of flexibility in model parameters through a regime switching behavior.

Given a time series of data xt, the SETAR model is a tool for understanding and, perhaps, predicting future values in this series, assuming that the behavior of the series changes once the series enters a different regime. The switch from one regime to another depends on the past values of the x series (hence the Self-Exciting portion of the name).The model consists of k autoregressive (AR) parts, each for a different regime. The model is usually referred to as the SETAR(k, p) model where k is the number of regimes and p is the order of the autoregressive part (since those can differ between regimes, the p portion is sometimes dropped and models are denoted simply as SETAR(k). They allow for changes in the model parameters according to the value of weakly exogenous threshold variable zt, assumed to be past values of y, e.g. yt-d, where d is the delay parameter, triggering the changes. The SETAR model is a special case of Tong's general threshold autoregressive models (Tong 1990). The latter allows the threshold variable to be very flexible, such as an exogenous time series in the open-loop threshold autoregressive system, a Markov chain in the Markov-chain driven threshold autoregressive model which is now also known as the Markov switching model.

6 Conclusion

From a pragmatic epistemological viewpoint, the concept of variability in time series analysis has evolved adapting itself to the developing of models where variability is assumed to be deterministic or stochastic. The first studies were done in the research domain of astronomy with simple regression or error models, where variability is assumed to be represented by simple functions of time. Time variability is present only in the systematic component which is assumed to be independent of the random component. In such case, we say that the time variability is of deterministic character because the observations are assumed to be independent random deviations from some function of time which represent the systematic part or signal of the process. Later, other models with stochastic time variability were developed where the impact of time is felt jointly in the systematic and random components. The data generating process of the phenomenon under question is assumed to follow stationary and/or nonstationary processes where, the non-stationarity is often present in the mean and /or in the variance. Models with stochastic time variability cover a large spectrum ranging from ARMA, ARIMA, RegARIMA, ARCH, GARCH , etc.

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The development of holidays made by residents in Italy from the years of economic boom to date

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Abstract In Italy the enjoyment of holidays has become a phenomenon rooted in the lifestyle of the population. The investigation of tourism demand started in 1959, by a sample survey on households. In those years, participation in tourism was still an elite phenomenon. Spending holidays has been increasing rapidly over the following years, becoming progressively more phenomenon of mass in the mid-'60s, during the period of economic boom. Until the '70s, holidays were associated mainly to the summertime period, choosing long holidays. Since the '90s a change in lifestyle of the population began to take shape, so there was a clear decrease in average duration, a fragmentation of holidays throughout the year and a growing numbers of short holidays. Nowadays the duration of longer holidays is about 11 nights and the share of short holidays and long ones is quite equal. Over time, the growing participation in tourism has been accompanied by changes in travel behaviours, such as the choice of means of transportation and the use of new technologies (internet) for travel organisation.

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1 The evolution of consistency of holidays

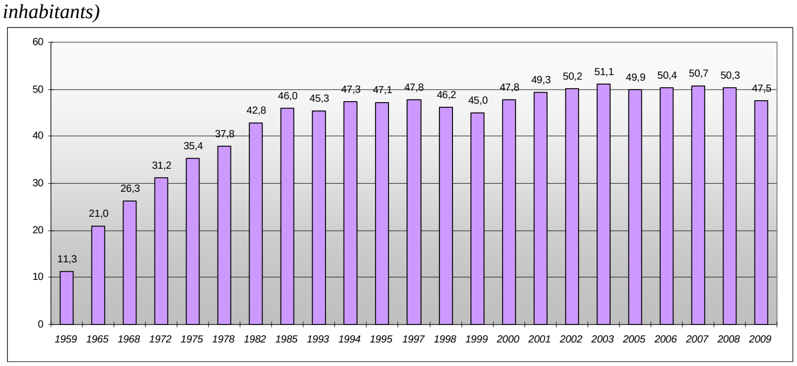
A key to understanding the evolution of the Country over time, is given by changes in lifestyle of the population, which also involve choices about spending holidays.

In Italy, the investigation of tourism demand started in 1959[2], when holiday periods spent by the population were investigated through a sample survey on households for the first time. In those years, participation in tourism was still an elite phenomenon and the proportion of people who made at least one holiday period was very small (only 11,3% of the population).

Spending holidays has been increasing rapidly over the following years, becoming progressively a phenomenon of mass in the mid-'60s, during the period of economic boom. In that period the increasing of households' income allowed a larger share of the population to access to holidays.

The share of people who made holidays in 1965 was 21% of residents and ten years later only (in 1975), it reached 35.4%. In the mid-'80s, tourism involved 46% of residents and in the early 2000s the share of tourists exceeded 50%, remaining almost constant thereafter (Figure 1).

Figure 1- *Share of residents who made at least an holiday of four plus nights - Years 1959, 1965, 1968, 1972, 1975, 1978, 1982, 1985, 1993, 1994, 1995, 1997-2003, 2005-2009(a) (for 100 inhabitants)*



(a) Data on tourism demand have been continuously collected only from 1993 onwards

2 Duration and frequency of holidays change overtime

Until the '70s, holidays were mainly associated to the summertime period, with average duration of about three weeks. Over the next decade, population spending holidays chose again long holidays in most cases. However, the need to quantify the

[2] For further information on methodological aspects of the ISTAT surveys on tourism demand see the references.

phenomenon of shorter holidays (less than four nights), which already characterized the tourism demand in our Country, also began to rise up.

Since the '90s a change in tourism lifestyle of the population began to take shape, so there was a clear decrease in average duration of holidays, a fragmentation of holidays throughout the year and a growing numbers of short holidays.

During those years, the average duration of longer holidays was around two weeks and short periods of holidays accounted for nearly half of all holidays. These changes grew ever stronger in the last decade: nowadays the duration of longer holidays is about 11 nights and the share of short holidays and long ones is quite equal.

Table 1 - *Average duration of long holidays (four and plus nights) made by resident population. Years 1965, 1968, 1972, 1975, 1978, 1982, 1985, 1998-2010*

YEARS(b)	***Average duration (a)***	***YEARS***	***Average duration (a)***
1965	19.8	2001	11.5
1968	19.1	2002	12.2
1972	18.9	2003	12.0
1975	18.9	2004	11.5
1978	18.7	2005	10.9
1982	19.2	2006	11.6
1985	18.9	2007	10.9
1998	12.5	2008	10.6
1999	12.3	2009	10.8
2000	12.2	2010	10.9

(a) Average duration of holiday trips is calculated in days until 1985, in nights spent from 1998.

(b) Data on tourism demand have been continuously collected only from 1993 onwards. In the period 1993-1997 data on holidays duration were not available.

The usual holiday period, typically long and enjoyed in the Summer months, has gradually been fragmented in the year and has also been accompanied by short holiday periods, distributed throughout the year. As a matter of fact, there has been a decrease in the number of persons taking a single long holiday period (from 73.1% of residents in 1997 to 64.6% of residents in 2009) and there has been an increase of people making two long holiday periods (from 17.7% of residents in 1997 to 22.3% of residents in 2009). The share of short-term holiday tourists has increased by about 5 percentage points (from 8.5% of residents in 1997 to 13.4% of residents in 2009).

The Summer period (months from July to September) is still characterized by long holidays, but, over time, even the non-Summer months have grown in importance for spending holiday periods, especially short ones. In recent years, the share of short holidays made in non-Summer quarters (January-March, April-June, October-December) has exceeded 60% of total holidays in each quarter.

Overall, the yearly ratio of short holidays has been increasing since 1997 (36.2% of total holidays), until it passed over long holidays ratio in 2008 (52.3% of total holidays). However, since 2009 the growing trend of short holidays was interrupted, even if they still represent an important segment of holidays (50.7 of total holidays in 2009, 46.5% in 2010).

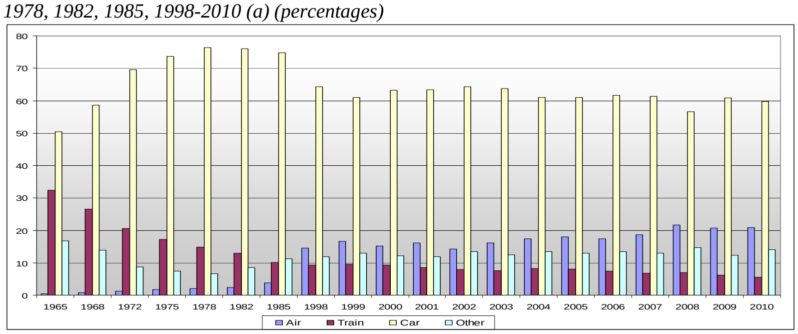
The gradual decrease in the duration of longer holidays from nearly two weeks to about 11 nights, and the increased number of short holidays, has meant in the last 15 years a gradual decrease in the duration of the holidays: from 8.8 nights in 1997 to 6.7 in 2010.

3 Changes in travel behaviour

Over time, the growing participation in tourism has been accompanied by changes in travel behaviours, such as the choice of means of transport and the use of new technologies for travel organisation, such as the use of internet.

The evolution of means of transport has been a very important development factor for the growth of tourism demand: in the period of economic boom the spread of the use of car has helped to transform the elite tourism in a phenomenon involving more and more people. The car remains the preferred means for long holidays, with values that have never been below 50% of cases from 1965, even though with variations from year to year.

Figure 2 - *Holidays of four plus nights by main mean of transport. Years 1965, 1968, 1972, 1975, 1978, 1982, 1985, 1998-2010 (a) (percentages)*



(a) Data on tourism demand have been continuously collected only from 1993 onwards. In the period 1993-1997 data on mean of transport were not available.

Since the 80's the affirmation of the aircraft as a mean of transport for long trips has opened new scenarios in the way of spending holidays because it allowed to reach far destinations in a short time.

The increase in the use of the aircraft as means of transport for long holidays (0.5% in 1965 to more than 20% in 2010) has been accompanied by a decrease in the use of the train (from 32.4% in 1965 to just over 5% in 2010).

The use of new technologies, and in particular the use of internet to book accommodation and/or transport, is something that has been studied in recent years because it has showed an exponential growth in a very short time. Over the past five years, in fact, there was an increase of about 60% in the use of internet for booking accommodation and/or transport, rising from 14.4% of holidays in 2006 to 27.8% of holidays in 2010.

This seems to be in line with more recent characterization of holidays, which is highly customized in the choices. Internet enables to collect information about places to visit, availability of means of transport and accommodation, low cost fares, but mainly it enables to choose the favourite combination of transport and accommodation. This recent approach identifies the so called "prosumer"[1], namely a tourist who produces the tourism product he wants to consume, creating his own customized trip experience.

4 Conclusion

Tourism is a continuously evolving phenomenon, which changes together with the society that expresses it. Since the beginning it has been shown a consistent grow both in the number of tourists and in the number of holidays (long ones and, later in the years, short ones).

Nowadays, the enjoyment of holidays has become a phenomenon rooted in the lifestyle of the population: despite of the situation of economic crisis of the recent years, people taking holidays did not gave up them at all. Even in 2009, when, for the first time, there was a significant decrease in the yearly share of tourists for long holidays, this has not occurred in the Summer quarter. As a matter of fact, in this period, which represents the *hard core* of tourism, also in 2009 the number of tourists taking holidays has remained quite stable.

Moreover, during last 60 years, Italy experienced the transition from a tourism characterized by the enjoyment of a unique long holiday, usually spent during the Summer period, to a tourism more diversified in the choose of periods, in the frequency and duration of holidays. These changes have been assisted by the increasing use of internet, that allows to build a personalized experience of holiday.

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[1] Neologism coined by Alvin Toffler in his work "The Third Wave" (1980)

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Statistics. Giovanni Montemartini's ideas and actions

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1. The economic paradigm by Giovanni Montemartini

In Italy, the 1890's ended with the theoretical affirmation of marginalism and the start of Nitti's economic policy - a policy aimed at supporting the growth of modern industry as a condition for the civil development of the Country through the use of numerous and sometimes contradictory tools.
Giovanni Montemartini was a professor of political economy at the University of Pavia and a student of Cossa's, along with other economists like De Viti De Marco. In Vienna, he studied with Carl Menger and through his writings he immediately introduced a culture where marginalism, reformism and socialism joined forces. In 1890, Montemartini, thanks to his job in the editing office of the "Giornale degli Economisti", became a member of the group of economists which, together with Ugo Mazzola, created the Italian medium of the new economic science (Faucci, 2000). He applied the "economic paradigm" to the model of public intervention in the economy. Marginalism and mathematical analysis formed his economic paradigm, meaning he completely accepted the disciplinary statute of the economic studies imposed by the neoclassic theories.
This statute included the idea of the political developer and the municipalisation of public services. Montemartini was certain that public intervention could be completely independent from the historical school and reinterpreted as an Anglo-Saxon economic model based on the balance and search of methodologies aimed at the efficient allocation of resources. Far from the paternalist frame of the Nationalekonomie, Montemartini also imagined a modern welfare system "supported" and "shared" by those subject to the policies. Although he never rejected the application of the abstract and mathematical method, necessary for the generalization of the economic phenomena, Montemartini was against a mechanical and timeless interpretation. He thought market balance conditions were actually influenced by "the various production elements." The conditions with a decisive role were "the different classes or economic groups, each one representing a productive

factor and all of them trying to take hold of the possible maximum amount of the total product”(Montemartini *La teorica delle produttività marginali*, Pavia, 1989, p.220).
Inspired by Fisher, he noticed that “a notion of usurpation and exploitation is at the base of complementary and cooperating relations”, which justifies the principle of class struggle in both phases of production and distribution. The terms of the social conflict described by Montemartini did not recall the Marxist theory of class struggle, which could not be generalized because of the particular historical context it made reference to.
This was enough to exclude its application from the numerous and heterogeneous organizational models of production that the developed countries were elaborating. However, there was something that Montemartini liked about the Marxist theory; it was the “gentle” way in which the method applied to that particular historical phase of capitalism when evident and unquestionable forms of exploitation existed in the relations between capital and labour. (ib. p.230).
According to him, a “logical” system had to be created that could recognise the marginal productivity of productive factors as well as the theory of distribution in such a way that the mechanisms of compensation or participation in the product could be explained.
Thus, the conflict or struggle between the economic groups (or social classes) originated from a tangible asymmetry of the phenomena that affected the market. This struggle could be understood and adjusted only through proper industrial policies and an effective control of the labour market that had to be implemented in a reformist and social perspective.(D’Autilia p.128 nota 108).
Montemartini realized that it was impossible to postpone contact between the political class and the real problems of the entrepreneurial class. A new “system of acquaintances” was needed and made possible by giving voice to associations of industrialists, engineers, and skilled technicians who had to collect, together with the working class, technical information on plants, work conditions, working hours and critical technical aspects of production.
He also noticed that the technological development that characterised the industrial revolution at the end of the 19^{th} century was rapidly introducing new and more complex production modalities, increasing investments and production and directing trade towards new and wider markets. According to Montemartini, all this created in companies a new need for coordination between the productive process and the internal function of technical management carried out by engineers and specialized technicians. In fact, Montemartini doubted the fact that market transactions among different companies (*price system*) could lead to this coordination.
As a result, companies of his time would always have a hard time due to the conflict between engineers and technicians on one side, and businessmen on the other, engendered by technological and productive needs of the first and the ambitions for bigger profits of the second.

It was necessary to get to the heart of the productive system to analyse, check, evaluate, and probably also adjust it through constantly updated studies and data. In fact, it was important for industrialists, engineers and technicians responsible for production to use their diagnostic ability to create a statistic of the industry. Montemartini introduced the method of "shared statistics" developed by those who created it.

Influenced by the crisis of legitimacy involving the management classes towards the end of the 19th century, Montemartini started to elaborate –through statistics- a model of communicative action to share points of views and objectives of those working in the productive sector. In fact, Montemartini wanted to create a strong relation between the most specialized workers and the public institutions with regards to an important information project shared by all. The relation between the industrial associations and the representatives of the culture of modern and innovative companies was fundamental. Two important representatives were the engineers Ernesto De Angeli and Cesare Saldini, who had dedicated themselves to the Società Umanitaria of Milano ever since it was founded at the end of the 1800's. In particular, Saldini, who in 1881 was already promoting the need to create professional training schools in Milan for young workers, wrote that the entrepreneur "....dominates his machinery and recognizes their friendly screeching, he is able to properly evaluate and appreciate workers, he is aware of how much they cost him and, therefore, is able to get maximum performance from his scarce resources" (C. Saldini, Milano industriale, in Milano 1881, p.336). In fact, according to Saldini the harmony between capital and labour was at the base of a linear and non-conflictual economical development that the Government was responsible for creating through the gradual integration of the various working classes in the new economic and social structures.

2. *Inspectors, Engineers and workers take part in the creation of an industrial statistic*

This led to the idea of creating a Labor Inspectorate at the Labor Office that had just been instituted at the Ministry of Agriculture and Trade (Law 29th June 1902) and led by Montemartini since 1903. The Inspectorate had to control the enforcement of social legislation, but had an even more important objective in creating an information database based on the conditions of industrial production interrelated to the work conditions of workers and management.

Since the very beginning, the Labor Office had the ambitious aim to become "an observatory of the social and economic facts that would punctually and precisely keep the Government informed on everything (Maic, Work Office, Reports on Work inspection (1 December 1906-30 June 1908), p. XLIII). Thus, according to Montemartini, it had to become the main means of providing administration with "the necessary contact with real life, with the real needs of the Country , with the spontaneous waves of interests, from and to where the work of the State must be oriented".

Until that moment, the work inspection function was part of the security police activities and the results had been very disappointing because of poor personnel formation. In fact, they weren't ready to understand and describe the new world of industry and enterprises (apart from those sectors controlled directly by the Royal Corps of Mining Engineers composed mainly of engineers working for mining and metallurgic companies). According to Montemartini, it was necessary to turn the role of "Gendarme State" into the role of "Educator State" able to collaborate with industrialists and workers in the project of creating a modern industrial system made for respecting the rules, constant training and, above all, technological development. The dissonance between the political context Montemartini belonged to and the industrial managers he talked to was shown by the parliamentary incidents.

The bill (date to check, but should be 1903) for the constitution of a specific Corps of work inspectors promoted by Senator Rava and voted down by the Chamber by secret ballot (date) had been supported, outside the Parliament, by that part of the industrial world that had to compete with the enforcement of the Italian law on the repression of infringements of workplace safety and also with the duties of the Italy-France Convention for mutual worker protection. Thanks to the Government contribution regarding the means required to carry out the inspection activity,- even if only experimentally, - the Labor Office immediately started recruiting industrial engineers (in addition to doctors, workers " with basic knowledge " and, for the first time, female inspectors).

Montemartini thought that the task to check industrial plants had to be assigned to "men already specialized in the service and able to assume responsibility for the performance of each unit and assure impartiality and seriousness" (p. XII).

However, the situation briefly described by Montemartini and considered "the most difficult part of the first setup of the inspectorate" showed that the model of collaboration among the world of the industries, the workers and the civil service could be created only if there were an agreement shared by common definitions. Being part of statistic information becomes the key to the inspection system.

3. *Companies' archive for the creation of the industrial statistics*

In the start-up phase, the organization plan that was developed for carrying out the inspection activities included the creation of four "Circoli" (sections): in Bologna, Brescia, Turin and Milan. Each "Circolo" – located according to the "strong industrial density" and the centrality regarding train connections" – was responsible for carrying out inspection activities in the factories subject to the woman and child labour laws and identified according to the “denunce di esercizio” (mandatory reports released by the factory stating the starting date of employment of the workers) received at the date of recognition. In 1907, the four “Circoli” included, for example, 11,000 factories for a total of about 800,000 workers. The circular letter regarding the inspectorate activities, signed by Minister Cocco Ortu on November 26, 1906, specified that the “The supervision of the application of factory worker laws” was limited by the fact that similar supervision organs already created in the past for homogenous business groups (according to the specific economic activity), were authorized to carry out assiduous controls together with the proper periodic reports on these controls. In underlining the particular importance of the new service, the circular letter provided indications on the need to carry out further in-depth studies and checks that had never been done before and that could have brought to light facts that were little known until that moment and, therefore, not easy to control. The circular letter stated: “After having established in what order the locations should be visited, those in charge of doing so will find an initial guide to the plants in each location in the registers listing the existing statements declaring start of employment period that can be found in the Prefectures and Municipals; but it is pointless for me to remind them that they must also visit the industrial plants that are subject to worker laws but that have not submitted the mandatory statements declaring start of employment period, since their task is to track down those companies, which we believe are numerous, that have not complied with this law”. (Maic, Circ.26-4-1906).

The collaboration offered by the Italian Industrialists Association to prevent on the job accidents assumed a fundamental role from the very start in giving life to the project. The Association in fact, provided two of their inspectors, engineer Pietro Brunati who became responsible of the “Circolo” of Milan (with 3,652 factories and 280,319 factory workers) and Engineer Italo Locatelli who became responsible for the “Circolo” of Brescia (with 2,348 factories and 189,698 factory workers). Engineer Effren Magrini was sent to Turin (with 2,580 factories and 200,164 factory workers) because of his vast technical and economic culture” and for his well-known competence regarding work hygiene and professional diseases. Engineer Teresio Mussa was sent to the “Circolo” of Bologna (with 2,125 factories and 93,336 factory workers) after having carried out about three years of activity with the “Sindacato subalpino di assicurazione mutua contro gl’infortuni” (an accident insurance company for workers). Industrial engineers who could then be given limited time assignments, were recruited by direct requests made to the regional Polytechnic Universities where the work inspectorates were founded, so that they could “indicate someone among those graduating from these Institutes who had the necessary requirements (…)”. As a result, eight engineers were recruited, including four from the Polytechnic University in Milan and four from the Polytechnic

University in Turin. As far as the choice of workers was concerned (those who would then represent the workers in the “Circoli”), those who had received their diploma from the Practical School of Social Legislation at the Humanitarian Society in Milan were selected. The resulting “Circoli” thus began carrying out their inspection activities in 1907 and producing reports containing important technical information in addition to economic and social information. The prefectures, as a result of the inspection activities organized in this way, were “requested”, by a specific provision indicated in the Circular letter, to take a step backwards. “You must also remember – indicated the Circular letter – that the work of the new inspectoral organism allows for Public Security personnel employed by this Prefecture to be exempt from having to visit industrial plants as far as worker laws were concerned; as a result, this Ministry will no longer allocate funds for payment of relative allowances. It will also be up to you to decide what limit to give to the visits made by the Royal police force, considering the fact that, on the one hand, repeated visits to the same plant should not be made due to the controls already carried out by the technical inspection organs and judicial police, while on the other, the Royal police in any case always has the power to verify and report crimes” (Maic, Circ., cit).

Another step had been taken towards the creation of a culture of persuasion and “participated” form of information. Testimony of the positive welcome given to technical inspectors is described in the various reports written by the various “Circoli”. These reports indicated the numerous requests made by the entrepreneurs for consulting services regarding the mechanical devices used in the factories, along with further analyses on the efficiency of the production systems of the various factories that were visited. Although it remained clear that a connection existed between the level of productivity and the organization of the production system, there was also a strong perception that better working conditions make relations between employers and workers easier, with positive results also on the internal organizational climate. Engineer Terenzio Mussa, head of the “Circolo” of Bologna, had this to say in the 1908 Annual Report: “ Inspectors have one of the most difficult tasks. In order to realize this, all you have to do is think that in a detailed, yet not excessively long visit, the inspector has to get a clear idea on the particular nature of the various types of machining processes carried out, on how the machinery works and the relative degree of safety of each machine, he has to support contradictions with the industrialists, examine registries, control dates and travel to locations that are difficult to reach and not always supplied with the convenient means of communication (…)”(Maic, Relaz. annuale, ott.1907-giu 1908, p.51).

A system of capture and classification of data, gathered during the visits at factories and plants, was created around the inspection activity.

In 1909, they succeeded in organising two files of companies: one for the real industry and the other for the so called "Firms" (in minutes). The aim was to "find a firm of which people knew only the name, it was just like including all the plants of the same branch".

Montemartini wanted to create the first big companies' files (called "card indexes") in which not only was there information about the enforcement of social legislation, but also about salaries, strikes, work hours, and these are just some of the entries. According to him, they could manage to create an industrial statistic able to classify (as it can be seen in the survey models created by the inspectors) "the branches of the industry" depending on the economic activities. This system of classification was being adjusted, in those years, after a long and complex investigating work, "with the main information about the potentialities of the plants and the conditions of the workers". The updating of the data was ensured by the periodicity of the inspections during the years. Montemartini explained the importance of this ambitious project by mentioning the laws that "applied equally to all set industry groups" could require a more and more punctual "estimate evaluation of the extent of their effects and the amount of plants and workers.

He was an advocate of the importance of the statistic information as a medium of modernization of the political and administrative actions of the ruling class of the Country and used as an instrument of analysis of the impact of policies. He stated that: "the first practical result of those new plants will be the statistics regarding the companies subject to the 1908 laws on women and children's work and on accidents; statistics that could show a picture not far from the thoroughness of the big and medium Italian industry". (p.XVIII).

4. *Montemartini Participative Statistics*

Montemartini had no doubts on the role carried out by the Inspectorate as "administration consultant" and "organ of Study and Statistic Revelations".

According to him, a modern system of industrial relations should have had to rely on a proper diagnostic activity capable of allowing for the creation of information aimed at supplying "the perfect knowledge of industrial conditions". The key to the success of the operation lay – as can be read in the Board meeting minutes from 1904 to 1906 – in the organizational model carefully constructed by Montemartini and corroborated by an active debate among the representatives of the interests making up the Superior Council of Labor of the Ministry of Agriculture, Industry and Commerce.

Overturning a conception of information "revelation" for statistical purposes based on the "verification" activities, Montemartini introduced a "participative" method in line with the philosophy of an “equal dialogue among the various social parties” that participate in the construction of the information. By trying to use categories that J. Habermas placed in democratic systems, we can consider Montemartini as a precursor of the ”procedural agreement” used as a method to – through the construction of authentic and share information – legitimately exercise the power of a managerial class aimed at overcoming the conception of a purely authoritarian State (J. Habermas, Teoria dell’agire comunicativo).

The need to provide both industrialists and factory workers with a modern system of industrial relations came from the ability to cooperatively exercise a diagnostic role aimed at assigning the information constructed together, a strength legitimacy that was unknown to liberal statistics up until that moment. In fact, this meant giving statistical information, transmitted in this case by the inspective function, the ability to unhinge a mechanism based on a system of silence and omissions that created a dangerous complicity among workers and entrepreneurs that was able to block information on the actual production structure of the country. The speech given by Ernesto De Angeli, president of the Association of industrialists in Italy in times for on the job accident prevention, during the Superior Labor Council in May 1904 was emblematic: “…the violations of the law were due to bad working habits, out-dated systems made with very poor means, in times in which no one worried about hygiene and work safety, to economic difficulties that lead workers and owners to make agreements among themselves to extend working hours and exceed the limits established by the law. As a result, the observance of the precise and total compliance with the social laws should be conceived not only as a result of negative speculation, but as an educative action of both production factors.”(Maic, Atti del cons. sup., III, sess. Maggio 1904, Bertero, 1904, p.78).

Experiences recorded by other countries such as England were quoted, where, although the inspective service boasted a long and consolidated tradition, the results showed a significant number of penal proceedings with regards to entrepreneurs who acted in an incorrect way or who did not comply with the law. According to De Angeli, coercion was not so useful. Italy, on the other hand, had the possibility of inaugurating a new tool based on a “moral propaganda that acted on owners and workers with persuasive methods(…)” (Ibidem, p. 79). The model proposed byt he industrialist from Milan, therefore, was aimed at creating a strong integration between the “private institutions” and administration, living the State the task of “organizing and integrating those prolific activities that have nurtured the same field they wish to cultivate and whose contribution were required in order to obtain positive results”(Ib.). Recalling the two control functions that characterize the inspective function, De Angeli divided them into surveillance (a specific “police” activity) and supervision, which requires a special preparation and technical culture. According to him, supervision did not require the creation of a further technical body of State officials in addition to those already existing (for example, the Civil Engineering Office or the engineers of the Royal Corps of Mining Engineers or those of the Italian Railway System), but neither could the engineers of the Association of Industrialists be responsible for all the inspections. Collaboration with the "civil society" (sic!) needed to be created, involving the civil society in an intense and capillary process of awareness of the benefits resulting from the proper application of the worker laws. On the contrary, the non-compliance with these laws would have led to "negative and illegal competition". Recalling the example of the Professional Corporations of Germany,, De Angeli quoted the results achieved by the Industrialist Association of Italy that he led, with 3788 registered plants and about 400,000 workers and with 2611 inspections carried out between 1900 and 1903, upon instructions from the Ministry.

It was now a matter of transforming, based on the example of what was done in Germany, the action carried out by the Association in a sort of "partnership" (sic!) between the industrialist organizations and the workers' associations. .

In substance, De Angeli wanted to "unite active forces that were well distributed throughout the country, gaining the support of persons of good will who would then be able to put those still deaf to the voice of duty on the right track " (Maic, Atti del consiglio sup. del lavoro, cit., p.81). With a position typical of a moderate Lombardy-based entrepreneurship aimed at achieving social reconciliation where the effects of industrialization and urbanization tended to drastically modify economic and cultural behavior, De Angeli, together with Saldini, represented a conception of supportive and humanitarian relations among the social parties at the Superior Labor Council.

Saldini, who was more specifically focused on the proper revelation of information and the analysis of the phenomena for diagnostic purposes, underlined the need to permanently add the inspection service to the Work Office since he considered it as "a useful social and study mechanism, strictly tied, even for study purposed, to investigating how the laws are applied and what are the resulting effects" (Maic, Atti, cit, p.81).

Saldini also insisted on the need to add the organization of surveillance and information revelation to the network of Associations, suggesting the creation of new organizations in case those existing were not sufficient. The entire institutional architecture, in the model proposed by the representatives of the industrialists, was made up of specialized technical bodies already active with the State administrations (inspectors, Civil Engineering Office, and Mining Corps) and engineers or technicians registered with the major industrial associations. In order to allow for the "worker class" to participate in the creation of a revelation and surveillance system based on an impartial method and that was shared by all, the presence of personnel represented by workers was foreseen in the “Circoli”, even though some resistance was put up by the industrialists. This resistance regarding the presence of workers in the inspection commissions was caused, above all, by the fear that they might circulate confidential information regarding the technology used in the most modern factories: “ often, an industry wins over the competition thanks to new devices and solution – explained Saldini – and it spends a lot in research, it copies what is done outside and so it cannot agree with putting all this at the disposal of someone who could use these new solutions for their own benefit or for others. The worker class could trust the Civil Engineering Office, the Mining Corps, but not the industrialist Associations. I would not be against allowing workers into the Associations if the right form were found, because this would prove the good faith and honesty that reign within the Associations and their intent to make sure laws are respected. In this way, these workers would be able to assure their colleagues the honesty of the intentions of these associations”(Maic, Atti, cit.).

The system of inspections made with the objective of monitoring, studying and correcting improper or even dishonest behaviour represented, therefore, an important occasion to create a common ground of action between industrialists and workers for the application of legislation, social legislation, which “ faced stronger opposition from the workers than from the industrialists, because it is not a legislation made with the workers, but with the State”, explained the Socialist Murialdi in a Council session.

The fact that the various social parties were able to jointly realize a system of statistical information to monitor the application of the law, but also to gain knowledge of a rapidly expanding industrial system that the liberal managerial class was unaware of, allowed Montemartini to realize his model. This model was based on the collaboration of all the subjects actively involved in the economical and social development of the country. The construction of statistical information was a way to define the relations that would have then given substance to figures and data that would no longer have been only “collected” by State “officials” but finally “proven” by those who were the main “constructors” of the data and figures themselves.

Bibliografia

Evaluation the labour policy through Compulsory Communications: the example of Labor Lab

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Key words: Active Job Policies, Processes, Monitoring, Evaluation, Administrative Data.

1 Abstract

This paper considers an evaluation theoretical model of labour policy proposed by Italy Lavoro S.p.A. and adopted by the Lombardy region. The aim is to verify the capability of the worked model to provide useful elements to the programming, the management and the policy evaluation. The Lombardy region started an experimental intervention with an active job policy (Labor Lab) focusing on both unemployed and atypical employees.

Definition of Unemployed: people expelled or never entered the labour market, over 35 (including 50% women), not recipients of benefits, except ordinary unemployment benefit.(Source: Handbook, May 30, 2008 Lombardy Region)

Definition of Atypical: temporary agency workers in the last two years have completed at least 8 missions;; Workers who have signed at least five fixed-term contracts; co.co.co. and co.co.pro. Recipients of an income not exceeding € 20,000 gross last year. (Source: Handbook, May 30, 2008 Lombardy Region)

Italia Lavoro was involved in this project to evaluate the general efficiency of the experiment and to define indicators to monitor the intervention.

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The continuous communication established between the monitoring and the evaluation divisions guarantees a good integration between the two parts.

The active employment policy uses a "Dowry Work" basis for professional integration. The public and private actors that are accredited and authorized for the management of employment policies can use it for professional employee insertion or professional employee new-insertion[1].

The process followed to define the monitoring system considers various interrelated activities to create value (the aim of the L.22) transforming the resources (regional founds, programming and governance capabilities) in a product (specific active policy employment activities) that is destined to an internal actor (the regional informative system, the independent evaluator, the accredited regional Agency for employment, etc.) and to an external actor (the accredited Agencies , the Employment Agencies, and obviously the policy recipient citizens).

The process, highlighting the existing actors and the relations between them, shows the information requirements needed by the decision makers, hence helping the definition of the indicators[2].

This is a central idea for employment and it takes place from what the local “logic of the program”[3], from what the stakeholders’ intentions and their social, political and managing ideas are, that is the ‘Mechanism idea’[4].

A map of all the actors and their reciprocal relations involved in the Lombardy Region active employment policies has been drawn in order to identify all the significant processes, as established within the 22/2006 regional laws and orders.

Observing the ‘conceptual map‘[5] it is possible to identify two main processes representing the relations between the various actors involved :”Accrediting” and “Policy Management”. The indicators may be defined once the process map is clear and the reference context is defined.

The following points were verified using the defined indicators:

- the functioning of the policy over the referred targets
- the capability to fulfil the active policy with the public and private actors
- the employment outcome of the recipient with the use of the Compulsory Communication

Relating to the first area the analysis of the results shows that for both the targets the financial endowment worked in almost the same way. If we consider the internal

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1 The take charge is a service pact concluded between a public or private operator and the beneficiary of active policy intervention, is the first step towards the construction of the personal journey of renewal and re-employment. It is the instrument through which the beneficiary of all the benefits of acquiring service of substitute declaration of unemployment, interview orientation, initiatives and measures proposed customized job placement or training or in occupational rehabilitation or other measures to promote the integration of employment, verification of compliance with measures agreed with the unemployed (Art. 13 LR 22/06 and Legislative Decree 181/00). Source: Handbook May 30, 2008 Lombardy Region.

2 See references [3]

3 Chen, 1990, and for a reference in Italian, Chen, 2007 (Stamen, 2007).

4 The reference to "mechanisms" is of course another approach, "realist", introduced by Pawson (see Pawson and Tilley, 1997, and for a reference in Italian, Pawson, 2002).

5 Bezzi C. (2008), concept maps for assessment, in “rassegna italiana di valutazione” year XII,n.41

success (num. of people inserted/num. PIP started) the percentage of the newly employed is practically the same.

On the other hand if we consider the efficiency indicator of the policy (num. of people inserted/num. of endowment available) the results differ completely.

For unemployed the efficiency index is 29% versus 12.1% for the atypical employees. The same trend is also found within the single provinces. The efficiency of the last case was therefore strongly conditioned by the choice of the target while programming.

The atypical employees used less than half of the endowment available .

As a consequence the Region made a new issue modifying the constrains needed to attribute the endowment. A new target was also included to share the latter (Re-employment)[1].

Very interesting results were also found concerning the ability of public and private actors to implement the active policy.

In view of a strong attractive capacity on the private side, (almost 85% of the recipients were taken from the latter), there was an internal success (num. inserted recipients/num. PIP established) for the public side (31,1% compared to the private's 22,7%). This suggests reconsidering a different way and different timing to supply the endowment. If the aim of the program is to employ, the payment of the operators or of a part of them becomes the final goal.

Another important consideration is finding a way to improve attraction capacity of the public individuals using a more efficient communication.

Employment outcome of the recipients through Compulsory Communications.

For this last analysis the compulsory communications of all the recipients that participated were extracted and processed. These data show an interesting panorama of the employment situation for the participants. For each individual the project entry and exit dates were taken into consideration (that is a positive ending or a PIP ending for those who were inserted at the end of the process).

For each individual the previous C.O. issued before the employment/newly employment process were obviously excluded.

Considering the "inserted" and "not inserted" groups separated some interesting considerations could be found. Analysing the C.O. 73% of the participants to the policy have a job contract (2.228 individuals that started a PIP). 33% of the latter is due to their participation to the Labor Lab (Direct Employment), in fact 535 of the participants closed the PIP positively.

[1] Redeployment: people with a unemployment status not older than six months from the date of signing of the Pact of service and people in CIGS or condition of mobility started by no more than 6 months from the signing of the Pact of service, whether that recipients or not recipients of social safety nets. Source, warning February 4, 2009Regione Lombardia

Table 1: Employment outcome of the Labor Lab recipients by Target

Employment status	Total		Unemployed		Atypical		Redemployment	
	n.	%	n.	%	n.	%	n.	%
Policy USERS	**2.228**		**1.595**		**536**		**97**	
Employed (from C.O. 30/04/2010)	***1.632***	***73%***	***1.132***	***71%***	***420***	***78%***	***80***	***82%***
Directly by LABORLAB	*535*	*33%*	*357*	*22%*	*151*	*28%*	*27*	*28%*
not directly	*1.097*	*67%*	*775*	*63%*	*269*	*70%*	*53*	*76%*

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Tourism statistics for local planning: challenges and proposals

Stefano De Cantis, Mauro Ferrante

Abstract The increasing importance of tourism in many urban and rural areas has called into question the adequacy of official statistical sources for specific local needs. However, several problems affect actual official statistics in tourism which make them inappropriate for destination management purposes. The present work starts from a simple question about the actual number of tourists in a given destination by formalizing the answer through a conceptual model which links official statistics available at local level with the tourism trips undertaken in the destination considered. The relevance of several parameters and quantities is highlighted and some proposals for their estimate are made. The importance of other information at local level, given the changing nature of demand and the increasing segmentation of the holyday market, is addressed.

1 Introduction

Having more and reliable statistics is essential for policy-makers to make effective decision, for designing marketing strategies, evaluating the efficiency and effectiveness of management decisions, and measuring tourism throughout the regional/local economy. By 1990 there was a growing awareness that the weakness of the statistical data and systems in tourism needed some major initiatives. However, despite the efforts demonstrated in the last two decades by national and international institution (WTO, 1994; European Communities, 1994; UNWTO, 2008) for improving the reliability and the comparability of statistical information on tourism, current statistics produced by

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The paper is a common work of both the authors; however, sections 1 and 3 are due to Stefano De Cantis, and section 2 is due to Mauro Ferrante.

national institutes seem to be still inadequate for destination management purposes, mainly at a local (sub-regional) level. Moreover, the increasing importance of tourism in many urban and rural areas has called into question the adequacy of official statistical sources for specific local needs. To date, to answer satisfactory to an apparent simple question such as "*how many tourists visited in 2010 a certain destination?*" is still an open issue, both under the theoretical and the applied perspective, since simply counting the number of tourists in a destination is not as simple as one might initially think (Smith, 1995:16).

Thanks to a co-funding of two National Research Projects, a group of social statisticians from University of Palermo and Catania directed by Prof. F. Vaccina, is working since 2003 on several topics related to the estimation of tourism flows in Sicily, through several approaches, aiming to integrate and to overcome the main problems of official tourism statistics, at regional and sub-regional level. Detailed results of these researches, are presented in two Italian book series: the series of statistical studies on tourism (published by Cleup company: see Giambalvo, Parroco, 2004; Parroco, Vaccina, 2005; Tomaselli, Vaccina, 2006), and the series in Tourism Sciences (published by Mc Graw-Hill Companies: Parroco, Vaccina, 2010; Oliveri, De Cantis, 2011). The aim of this paper is to summarize some theoretical considerations underlining these researches, by discussing the main problems and challenges of tourism statistics, in relation to an adequate monitoring of tourism flows at local level.

Next section presents a general framework for the estimation of number of tourists in a given destination starting from the information on guests arrivals derived from the supply-side statistics on collective establishments. Challenges and proposals regarding the actual system of official statistics on tourism are made, within the logical framework presented. Final remarks in the last section conclude this work.

2 A framework for tourism statistics at local level

At present, in Italy, detailed information on tourism demand comes from surveys carried out at a national level by the National Institute of Statistics (ISTAT) on domestic tourism, and by the Bank of Italy for international tourism. However, both these sources do not give any information at sub-regional level, since they are not designed to give local information. This imply that the only available local information are provided from the supply-side statistics on guests in collective establishments. However, there are several problems which affect statistics from the supply-side. First, not all tourists stay at collective accommodations, and those who do not might have very different patterns of behaviour than those who do. Some kind of accommodations, in fact, are not included in the survey from the supply-side at all, such as second houses, boats, relatives and friends houses, and so on. We will call this component of tourism demand "ignored tourism" (Parroco, Vaccina 2004). Second, as for many other economic activities, accommodation responsible may choose to declare only part of their guests in order to avoid direct or indirect taxation. We will call this component "hidden tourism" (Parroco, Vaccina 2004). Third, visitor while on a trip might stay in more than one collective accommodation, resulting in an overestimation (i.e. the "double counting effect") of the number of visitors and an underestimation of the total duration of the stay within the destination considered (Pearce, 1995; Lickorish, 1997;

Parroco, Vaccina 2004). Moreover, the magnitude of this phenomenon strongly depends on tourists mobility within and between destinations, and on the geographical level undertaken, since the "double counting effect" increases as the geographical scale decreases. Fourth, no information on visit motivation is collected from the supply-side, making it impossible to distinguish tourists from other guests (e.g. seasonal workers, students, etc.).

Given these considerations, we formalize a conceptual model of actual tourism in a destination, by expressing the above problems in terms of parameters and/or quantities to be estimated. Let be ${}^{obs}G_{i,t} = \alpha({}^{obs}A_{i,t})$ the number of tourists arrivals registered in official accommodation establishments (where α represents the proportion of guests arrivals ${}^{obs}A_{i,t}$ with touristic motivations), in the i-destination, during the time interval t; and let be β the average number of establishments used by tourists during their stay within the destination considered ($\beta \geq 1$). The number of tourism trips ($TRIPS_{i,t}$) in the destination i, during the time interval t, would be equal to:

$$TRIPS_{i,t} = \frac{\left({}^{obs}G_{i,t} + {}^{unobs}G_{i,t}\right)}{\beta} = \frac{\left[\alpha\left({}^{obs}A_{i,t}\right) + {}^{ign}G_{i,t} + {}^{hid}G_{i,t}\right]}{\beta}$$

where: ${}^{ign}G_{i,t}$ is the number of tourists which used establishments for which information on arrivals and nights spent are not collected ("ignored tourism"); and ${}^{hid}G_{i,t}$ is the number of tourists which used official accommodation establishments, but were not declared to public authorities, mainly for fiscal reasons ("hidden tourism"). Supply-side survey provides information only on the number of guests arrivals in official establishments (i.e. ${}^{obs}A_{i,t}$); on the contrary, the last two aggregates needs to be estimated. Finally, the information that is particularly relevant is the coefficient β (i.e. the average number of accommodation establishments used by tourists during their stay). This issue falls into the broader phenomenon of tourists mobility; a topic which is almost ignored by actual official statistics. This framework allows to face with the problem of quantifying the number of tourists in a given destination through a correction procedure of the available official data on guests in collective establishments. With reference to the motivation coefficient α, it should be kept in mind the characterization of the destination. In tourism resorts, it could be assumed that all guests are tourists (i.e. $\alpha = 1$), however, this hypothesis would be unreliable in urban destination where other guests (e.g. workers) are likely to visit the destination and stay in collective establishments. In these cases, an estimate of α, obtained for example through a sample survey on official establishments would be required. The ignored component of tourism demand is closely related to the presence of the so-called "un-official establishments" such as second houses, rooms or houses rented. The quantification of the number of second houses in a given destination, for example through information coming from the census on population and housing could help to understand the magnitude of the ignored tourism in the destination considered. Finally, regarding the β parameter, next to nothing is known about the number of destinations visited (nor of the number of establishments used) by tourists. However, for small areas, such as municipalities a value of $\beta = 1$, whereas for larger areas, such as tourism districts, or Provinces, an estimate of β would be required. Vaccina and Parroco (2004) proposed to integrate the actual survey on guests in collective establishments with information on the potential place of origin before getting into the establishment and on the potential place of destination after the visit to the establishment. According to the authors, this would allow to reconstruct the paths of the trips undertaken by tourists, and to correct official statistics for the double counting effect. Interesting results derived from a sample survey conducted in Sicily and Sardinia in 2009-2010 are contained in a forthcoming work (Oliveri, De Cantis, 2011).

3 Final remarks

Increasingly regional tourism authorities are interested in regional statistics. However, as highlighted in this work, at sub-regional and local level demand-side statistics are not provided. This determined the habits of use accommodation (supply) statistics to evaluate tourism demand. However, the use of supply-side information to evaluate demand-side features can determines conceptual and practical mistakes. According to the framework proposed, not only the differences in concepts should be bear in mind (e.g. arrivals vs tourists), but also the importance of the un-observed component of tourism demand, and of the parameters related to guests motivations (α) and to tourists mobility (β) would require much more attention. A deeper knowledge of tourists behaviour could help to determine the values of these parameters and the factors affecting their variability. Furthermore, the changing nature of demand and the increasing segmentation of the holyday market are also raising the need for more accurate, regionally-based, information which integrate quantitative information on the magnitude of tourism with other more qualitative aspects of tourism behaviours.

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The Role of Women in the New Millenium Entrepreneurship

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Abstract The aim of the paper is to study the transformational factors of the Italian entrepreneurial system from a gender perspective. According to this approach, what comes out is an exploratory operation on the characteristics of women's entrepreneurial structure and the gender differences that still persist in the business world. ISTAT data on entrepreneurs will be used for this application.

Keywords: Entrepreneurship, Women, Social Change, Labour Market.

1 The labour changes in a gender perspective

Significant changes in the labor and business world have marked the last century. The main changes include the integration into the labor market of some social categories defined "weak" that drive the attention of institutions and firms on new issues at the organizational level [3]. Among these, the women have significantly contributed to job offer and have made more dynamic the employment structure.

The concept of the feminization of the labour force has become more relevant in the studies about the transformations of labor market since Post-Industrial Society to the current Knowledge Economy [6]. It defines the quantitative growth of the female working population. It also refers to the qualitative dimension regarding the importance of the new skills and knowledge required by the changing production contexts within the Informational Paradigm [1].

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However the feminization has still to face significant differences between women and men. In Italy today employment statistics show that the gender gap of participation in the labor market is declining, although significant differences still persist when compared to other European Countries. This is despite of a general context in which there has been an increase of flexibility in the forms and methods of employment [5].

The raising of education levels throughout the last five decades represented an essential step for women's access to occupations, including economic activities sectors and social positions that were once foreclosed. Today women are increasingly able to overcome the obstacle of vertical segregation and break through the *glass ceiling,* thus reaching top positions also in the business. In fact, the European benchmark shows how Italy simultaneously has the lowest employment rate within EU Countries, while it ranks among top positions in the female entrepreneurship.

In this perspective, the paper aims to highlight the entrepreneur as unit of statistical analysis in order to better understand the female participation in the labor market. The proposal intents to be an application that explores - with an innovative approach - theoretical models and consolidated methods of analysis. The female entrepreneurship becomes an original perspective to study the role of the women in the labour market and business sector. Specifically, the study will refer to the following categories of micro-business: self-employment-firm, freelance, (free) professional.

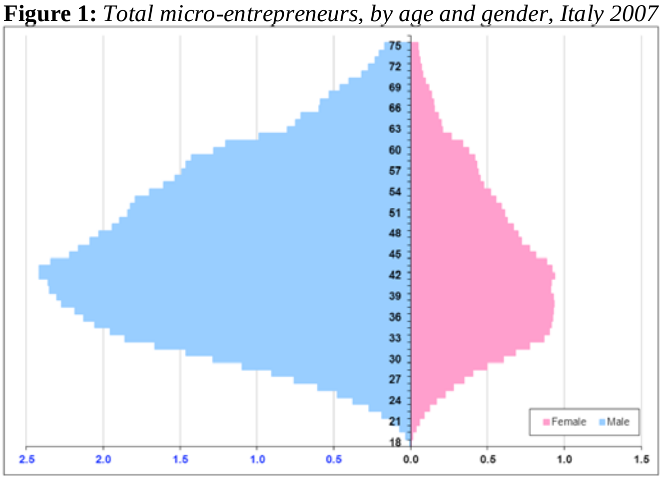
2 The woman entrepreneurship: the role of young (free) professionals

The following analysis focuses on female micro-entrepreneurship using ISTAT data (year 2007) and underlining the gender differences and trends.

Looking at population pyramids (Fig. 1 and 2) important aspects related to dynamics of female entrepreneurship can be detected. Fig. 1 describes the total population of micro-entrepreneurs showing a trend of growth for women entrepreneurs, especially thirty-year-old ones. The male entrepreneurs instead include a broader age group: from thirty year-old to fifty-five years old (over 1,5% by each birth age). Even if younger, the female entrepreneurship shows a faster growing trend, which leads to important changes to behavior and participation patterns in the labour market. Considering that 20.7% is the value of the total population, 24.3% of women against 19.3% of men is below thirty-five years old.

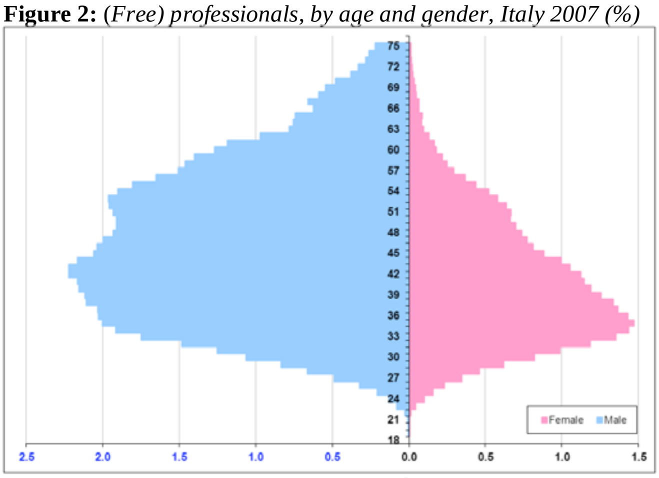
Comparing women and men, an exchange in terms both generational and gender has been observed. Traditional entrepreneurial class turnover is absorbed by highly professional young women who new comers in the labour market. In detail (Fig. 2) the more dynamic group entailing (free) professional women has been considered on the most significant aspect. In this group the main generational movements are observed. The most significant growth is among youngest generation: the largest share of professional women is under forty years old.

Figure 1: *Total micro-entrepreneurs, by age and gender, Italy 2007 (%)*



Sources: Data processing on ISTAT-ASIA archive.

Figure 2: (*Free) professionals, by age and gender, Italy 2007 (%)*



Sources: Data processing on ISTAT-ASIA archive.

For women, therefore, the (free) professional is the most common choice with regards to the autonomous career. In 28.1% the women are (free) professional against 24.3% of men (total population 25.3%). Interestingly, with regards to the territorial indicator young women (free) professionals are concentrated in the north, particularly in the north-west (Tab. 1).

However some critical aspects remain. With regards the business sector, Tab. 2 shows women mainly operate in areas that the literature defines a high rate of feminization. In a hand, they are concentrated in the public relations activities (*wholesale and retail trade* and *accommodation and food service activities*); in the other hand women operate in service activities that include both the *health sector* and *personal services activities* (10.5 % are women against 2.2% - total population 4.5%). Finally we observe the persistence of a form of *horizontal segregation* that still sees women concentrate in activities where their social and cultural characteristics seem more congenial [7].

Table 1: *(Free) professionals on self-employment–firms, by territorial area (NUT2) and age, Italy 2007 (average rate=1)*

Age	**Centre**	**Island**	**North-Est**	**North-West**	**South**	**Total**
< 35 years	1.29	0.84	1.39	1.42	0.76	1.17
35-49 years	1.22	1.01	1.09	1.21	0.98	1.12
50-65 years	0.77	0.63	0.71	0.81	0.56	0.72
65 years and +	0.33	0.15	0.28	0.49	0.14	0.31
Total	1.08	0.84	1.02	1.13	0.80	1.00

Sources: Data processing on ISTAT-ASIA archive.

Table 2: *Women and man, by economic activities, Italy 2007 (%)*

Economic Activities (NACE Rev 2)	***Women***	***Men***	***Total***
B: mining and quarrying; C: manufacturing; D: electricity, gas, steam and air conditioning supply; E: water supply; sewerage, waste management and remediation activities	6.2	8.1	7.6
F: construction	0.9	19.2	14.3
G: wholesale and retail trade; repair of motor vehicles and motorcycles	**33.3**	**27.3**	**29**
H: transportation and storage	0.6	4.2	3.2
I: accommodation and food service activities	**7.1**	**3.7**	**4.7**
J: information and communication	1.1	1.7	1.5
K: financial and insurance activities	1.3	1.9	1.7
L: real estate activities	1.2	1.1	1.1
M: professional, scientific and technical activities	**20.5**	**19.6**	**19.8**
N: administrative and support service activities	4	2.4	2.9
P: education	0.7	0.3	0.5
Q: human health and social work activities	**10.4**	**5.6**	**7**
R: arts, entertainment and recreation	1.8	1.8	1.4
S: other service activities.	**10.9**	**3.1**	**5.3**
Total	100.0	100.0	100.0

Sources: Data processing on ISTAT-ASIA archive.

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The evolution of statistic information on agricultural labour force through the agricultural censuses from 1961 to 2010

Loredana De Gaetano

Abstract The main purpose of this paper is a brief analysis on the trend of the collection of statistical information on the holdings' labour force in six Italian agricultural censuses (1961-2010). The aim is to show how the agricultural holding's management has actually changed in terms of entrepreneurship supported by a sufficient level of agricultural expertise and, especially, to identify and quantify the phenomenon of the appeal by the agricultural holdings to other workforce than strictly family. The paper will illustrate the evolution from 1961 to 2010 occurred in the information of Labour Force, included in a specific Section in the holding's questionnaire of each census, in the light to offer as possible to all the users a comprehensive picture of the changed agricultural working reality in Italy.

Keywords: Agricultural census, Labour force, Questionnaires, Statistical information

1 Introduction

It's taken for granted that an agricultural census shall take into account as far as possible, either the recommendations of the United Nations Food and Agriculture Organisation (FAO) on world agriculture censuses or the Community regulations on the carrying out of the Community surveys on the structure of agricultural holdings. This legislation requires Member States to carry out, at least every ten years, an exhaustive survey (full census) of all agricultural holdings in order: to monitor the

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evolution and dynamics of the agricultural sector; to acquire useful information for the calculation of the economic accounts for agriculture; to establish and / or update the basic registers of production units in the sector (agricultural holdings), as well as to have the new information necessary for the proper performance of the infra-census sample surveys on specific aspects of agricultural and of major national interest. In this regard, it should be noted that any information gained from the censuses through appropriate questionnaires are increased in number and complexity from one census to another, in order to obtain and allow a more faithful and comprehensive representation of agricultural reality of reference. More generally, the *product census* has seen steady incremental improvements, either in terms of timeliness and dissemination of results, or the spatial reference of information, or for the fulfilment of sub-national information needs and as concerns the degree of uniformity and comparability with the results of other Member States. This is because it remained at the same time an urgent need to satisfy the need for comparability with the previous censuses, for which the census questionnaire has grown each time in volume, highlighting further that, given the precious opportunity of every ten years of obtaining timely information on the whole of agricultural holdings at a rather fine territorial detail (the administrative municipality), at the moment of the design plan of each census it is always inevitable to ask new information and very difficult (if not almost impossible) to *cut* some questions among those previously surveyed. In particular, among the information needs that have arisen strongly, especially since the census of 1990, a more careful information on the territorial reference and the establishment and relevant updating and management of the farm register as part of that broader established under Regulation EEC No 2186/93 of 22 July 1993 [1] stand out, with the main goal to have continuous information on the agricultural sector that would allow to mitigate in the future the statistical burden caused to the agricultural holdings with the sample surveys, since a part of the information could be gained by using only administrative sources. Given, therefore, the importance of agricultural censuses for the punctual knowledge of the sector and for the consistency with Community policies in Italy and for planning and programming decisions of stakeholders and interventions at local levels, this work intends to review the changes of definitions correlated, for brevity of presentation, to one of the three factors that characterize the survival of an agricultural holding, ie the type and amount of farming work done in the holding for its production activities, through a brief analysis of the typological diversity of the categories of worker categories who perform it.

2 The demand for information on the labour force in the agricultural census

2.1 At international level

The initial input for assessing from time to time the opportunities and the need to review the request of information on the agricultural work done on holding is always arisen from the requirements at Community level codified with the reference legislation

of the structural survey on the agricultural holdings. In this regard, it should be stressed that during the years, the EU demand, supported by the recommendations of FAO, had taken an increasingly large and varied configuration, according to both the increased information needs for the implementation of trans-national policies and of structural and socio-economic reforms and of continuous enlargements to very different and not fully aligned agricultural situations between them and with those already part of the EU at the time of their access. It follows that the information importance of an agricultural appears inevitably and significantly affected by the following basic directions:
a) the information collected should refer to structural, productive, environmental and socio-economic aspects of the agriculture subject on the one hand to present some significant changes mainly in the long period, the other side, to follow closely as possible the contents used in previous census rounds, with various and appropriate changes and additions for taking into account the acquired experience and the recent development of the agricultural realities of ;
b) It is suitable, if not essential, to take into account the recommendations of FAO;
c) is compulsory for Italy, as EU Member State, to fulfil what was agreed and stated with the EU regulations on the farm structure surveys.
Therefore, FAO, even clarifying that variables and information are not all applicable to each country, but flexible and with possible changes from one country to another, has always offered basic headings that are directly and realistically suitable to describe the local situation and to meet specific national needs. The characteristics considered by the reference Community legislation of the various agricultural censuses, fully based on that suggested by FAO, reecho the same information content, even if adapted to the configurations of agriculture in European countries and often integrated by some variables useful for discriminating particular holding's subsets. In this regard, it seems appropriate to report for each agricultural census the Community legislation describing also the characteristics to be collected for the *Labour Force* part.

2.2 At national level

The agricultural development has been influenced by technological progress, which offered the possibility of maintaining and expanding the economic advantage of some products characterized by a high degree of farming activities, by the employment of agricultural labour force also in some industrial and service sectors, by the reduction of the number of agricultural family members, partly for reasons shared with other families and partly for searching for a different living environment and a higher degree of quality of life. In particular, the development of the industry and the tertiary sector and the migration north-south and east-west of our country have easily absorbed the excessive labour force in the agricultural world, especially occasional workers, due in part to the land interventions of the '50s. A steady increase of the employment in non-agricultural activities has been accompanied by a continuous decrease of employed people in agriculture. Another interesting demographic aspect is the significant presence of women in agriculture and of old people. The evolution of agriculture is also due to the decrease and the transformation of the agricultural labour force; in some areas the agricultural families still work at home for the industrial enterprises and some non-agricultural activities, which were previously carried out on the holding, are increasingly carried outside (production of wine, olive oil, cheese, etc.). On the other hand in the holding or, anyway, by the holding's labour force, new activities are developed such as rural tourism and contract work by thirds [2]. Since the early '70s in Italy the further need of agricultural information arised by a broad and diverse range of users, especially public, such as municipalities, particularly interested in the detailed territorial information on agriculture, and the regions [3,4]. In the past, the demand for agricultural information concerned a group of products or livestock species depending on the needs of the population. In fact, for example, the first requests for statistical information have interested the mules, because the driving force, for so many decades, of military equipment and weapons, the wheat in particular and the cereals in general, as the only representatives of the food base of the population. To these first information needs the equally important demographic aspects of the agricultural sector followed, as well as those on area and production of cultivations, rather than about the agricultural holding in all its structures. Until the late ‘50s in Italy the demand for information on the agricultural holding was low and limited, unlike the surveys carried out by other Western countries. This fact, together with highly decentralized organization of the Italian agricultural statistics, allowed to develop more extensive surveys based on the estimations [4,5,6]. In parallel in order to better meet the necessary increased community needs, at national level the demand for information on the agricultural sector by private users (supporting for the decisions of farmers) increases, but mostly public, such as regions and local bodies, mainly municipalities for the planning of interventions of agricultural policy. The attention expands, over the years, gradually to particular aspects of farming, and in particular to the agricultural demography, the structure of the labour force employed, the amount of working days performed for the agricultural and not agricultural activities, as well as to the type of these latter [6,7,8,9].

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Regional differences in infant mortality from the nineteenth to the twenty first century

Giulia De Candia

Abstract The analysis of infant mortality rates, registered in the Italian regions from the end of the 19th to the beginning of the 21st century, shows large regional differences in levels and rates of reduction. This gap has widened over the years, bringing out an unfavourable position of Southern Italy compared with the rest of the country, because in the South are concentrated geographical pockets of high mortality. Analysing the evolution of infant mortality over time and comparing different territorial realities also with regional per capita product, some remarks are proposed about the factors that prevent the convergence to the minimum levels of infant mortality rate.

1 The data sources

This study is based on annual time series of regional infant mortality rates from 1863 to 2007, built by the author from data published by Istat (1975, 1983, 1986-1993, 2011). Table 1 shows part of this database, obtained selecting some years of the time series.

It is necessary to specify that in the period 1863-1973 the infant mortality rate was calculated on present population, while in the period 1974-2007 it based on resident population. Furthermore these data come from yearbooks and then refer to the boundaries of the time.

Yearly series of Italian regional per capita product in the period 1891-2004 were reconstructed by Daniele and Malanima (Daniele V. and Malanima P, 2007).

2 The decline in infant mortality and the growth of the regional gap

From the nineteenth to the twenty first century infant mortality rates (IMR) decline in a sharp and continuous way in all the Italian regions, with the exception of erratic fluctuations and the years corresponding to the two world wars, when rates increased. In 1863 the number of deaths under one year old per 1000 live births was in Italy equal to 231,6‰ and, in all the regions it was higher than 200‰, except for Liguria, where it was 189,1‰. In 2007, the last available data, the national infant mortality rate is 3,3‰, with a decrease of 98,6% from 1863. The reasons for this decline are attributable to the improvement of living conditions of the population, the rise in the economic standard of living, the progressive widespread of health and social care, the improvement in hygienic conditions, the introduction and extension of new prophylactic, therapeutic, surgical and diagnostic measures, the improvement in alimentation (Del Panta, 1997).

The reduction rate of infant mortality in Italy wasn't homogeneous for all the period analysed: the end of the second world war marks an important breakpoint between the linear trend of the first period 1863-1945, when the average annual rate of decrease was

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1,0%, and the exponential drop of the second period 1946-2007, when the average annual rate of decrease reached 5,1%. The socio-economic and medical progress occurred after the second world war quickened infant mortality drop.

Table 1: *Infant mortality rates by region and year*

YEARS	1863	1871	1881	1891	1901	1911	1921	1931	1941	1951	1961	1971	1981	1991	2001	2007
Piedmont	238,2	211,3	176,7	159,5	148,2	142,6	110,7	92,6	85,3	48,8	36,4	28,3	15,5	6,5	3,6	2,8
Valle d'Aosta	….	….	….	….	….	….	….	….	….	71,4	29,9	20,3	11,2	4,0	3,6	3,3
Lombardy	258,5	220,5	194,1	184,8	192,6	183,6	152,1	133,2	116,3	61,5	35,2	24,3	11,9	6,7	3,9	3,0
Liguria	193,6	193,6	170,1	152,9	144,3	127,5	92,9	73,4	66,3	41,1	28,1	23,7	11,8	6,4	4,5	3,6
Trentino Alto Adige	….	….	….	….	….	….	….	112,7	85,2	52,6	33,3	24,1	10,6	5,1	2,3	2,8
Veneto		245,9	190,4	174,5	150,5	149,2	121,8	87,4	84,5	46,9	29,8	19,8	11,0	5,3	2,4	2,9
Friuli Venezia Giulia[a]	….	….	….	….	….	….	….	115,7	103,5	47,2	29,6	20,6	9,5	5,0	3,7	1,5
Emilia Romagna	251,2	277,4	203,4	212,2	176,5	153,0	125,3	92,8	78,2	45,4	30,8	24,2	11,6	5,9	3,6	2,7
Tuscany	228,9	214,6	164,7	167,0	142,1	127,9	99,1	69,3	70,4	41,4	26,4	22,7	13,0	6,5	3,3	2,6
Umbria	256,2	232,5	194,5	168,8	163,4	143,3	117,3	88,0	86,0	43,6	28,2	24,1	10,7	8,4	3,0	2,8
Marche	259,0	261,5	202,6	203,9	151,1	138,9	128,1	87,7	78,5	49,4	28,9	17,8	11,2	6,5	4,3	2,7
Lazio			195,0	164,4	139,8	131,4	99,2	91,1	88,6	56,8	34,8	25,2	12,2	7,8	4,4	3,6
Abruzzo[b]	220,9	223,7	184,3	189,5	165,4	154,6	138,3	126,1	125,0	76,5	43,5	22,6	14,3	8,6	5,0	4,5
Molise[b]	220,9	223,7	184,3	189,5	165,4	154,6	138,3	126,1	125,0	76,5	43,5	24,5	14,6	10,6	5,8	2,8
Campania	204,8	229,8	203,5	190,6	171,9	163,3	119,6	120,5	148,3	77,4	54,5	42,9	16,8	10,7	5,4	4,1
Puglia	224,2	249,3	193,9	203,3	188,0	165,8	154,5	142,8	153,1	89,1	54,3	32,5	17,8	9,1	5,6	4,0
Basilicata	259,7	221,7	204,4	207,4	168,9	171,8	160,9	174,9	196,8	120,4	59,6	34,4	16,1	10,4	5,0	0,2
Calabria	232,3	194,1	196,3	168,8	157,9	147,8	128,7	120,8	154,0	85,6	50,3	33,2	15,6	10,3	5,9	4,9
Sicily	211,5	211,4	210,4	192,6	180,8	179,8	152,3	141,3	150,5	80,6	47,1	34,7	17,6	10,3	6,3	4,3
Sardinia	210,7	214,5	176,4	154,8	140,5	130,4	133,2	117,1	118,1	69,0	41,0	28,0	13,6	7,5	3,9	3,0
ITALY	231,6	227,2	192,2	183,8	166,3	156,7	129,3	112,9	115,2	66,6	40,7	28,5	14,2	8,1	4,4	3,3

Source: Istat

(a) Till 1945 Venezia Giulia and Zara

(b) Till 1962 the rate is calculated for Abruzzo and Molise together

Territorial comparison shows deep differences in IMR: in fact, the analysis of the variation coefficient between regional IMR, points out as the relative variability between rates, after having maintained steady levels around 10% in the period 1863-1910, grew constantly up to its maximum level in 1939 (38,7%), dropped in the next forty years till about 18%, and then start again to raise and reach values above 30% in the new millennium. The difference between regional IMR shortened in absolute terms (fig.1), but increased in relative ones (fig.2).

Analysing regional data, we can notice a different behaviour between north, centre and south of Italy. If soon after the Italian Unification southern regions had IMR lower (Campania and Sardinia) or slightly higher (Puglia, Calabria and Sicily) than the national one, since the beginning of the twentieth century they maintain high levels of infant mortality and show a certain delay in reduction rate comparing with the others Italian regions up to the present days.

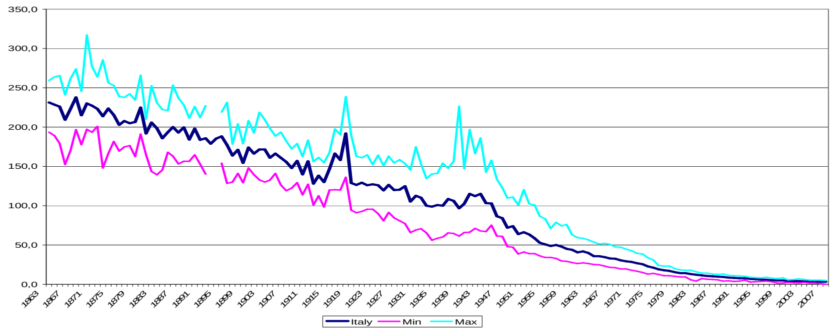
The Sardinian case is significant: in the decade 1871-1880 Sardinia was the region with the lowest infant mortality rate in Italy, even if the social economic conditions were precarious. Coletti (1908) identifies the determinants of this phenomenon in some good practices, whose spread was peculiar of the island, such as breast-feeding and constant presence of the mother in the care of the infant.

The drop of infant mortality occurs earlier and faster in the central and northern regions, where in 1946 all the IMR were abundantly below 80‰ while in all the southern regions they were above 100 ‰ (except for Campania with 99,1‰). Also the average annual rate of decrease in the period 1863-1945 is higher in all the central and northern regions, where it exceed 0,9, than in the southern, where the rate is below this threshold.

In the period 1946-2007 southern regions had an annual rate of decrease of infant mortality equal or higher than the national one, (except for Abruzzo, Campania and Calabria where it is slightly lower), but not sufficient to recover the situation of disadvantage with respect to northern and central regions.

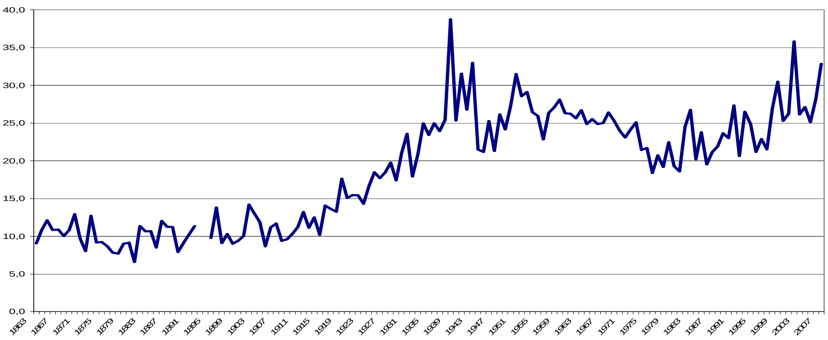
In the early twenty-first century we can still identify geographic areas with high mortality rates, all concentrated in Southern Italy: in 2007 the IMR in Abruzzo, Campania, Puglia, Calabria and Sicilia was more than 30% higher than in the northern regions.

Figure 1: *Infant mortality rates in Italy compared with the time series of the regional minimum and maximum - Years 1863 – 2007*



Source: elaboration on Istat data

Figure 2: *Coefficient of variation between regional infant mortality rates – Years 1863 – 2007*



Source: elaboration on Istat data

3 Relation with regional per capita product

The study of the correlation between regional infant mortality rates and regional per capita products for the period 1891-2004 highlights the following aspects and implies the following considerations.

The correlation between regional infant mortality and regional product is negative and increases (in absolute value) with the increasing time: in the late nineteenth century the correlation is weak, in fact there are regions such as Sardinia and Calabria, with low infant mortality and low per capita product, and regions such as Lombardy and Campania, with high infant mortality and high per capita product. The economic development of a territory is not enough to ensure a high infant survival, because other factors may interfere, as we have seen for the Sardinian case. In Lombardy, the increasing presence of women in industrial activities has caused a worsening of their health conditions and a premature separation of children from the mothers, bringing an increase of infant mortality (Del Panta, 1997). In the course of the twentieth century the correlation between infant mortality and per capita product becomes stronger, so the low levels of infant mortality concentrate in the more economically developed regions.

Moreover since the thirties of the twentieth century, when the negative correlation between infant mortality and regional product begins to be considerable, a situation takes form where central and northern regions with high per capita product and low infant mortality contrast with the southern regions with low per capita product and high infant mortality. These North-South disparities deepen in the course of time and are still present in the twenty first century.

4 Final remarks

Infant mortality depends on different factors, biological, environmental, social, economic and cultural, but the weight and the features of these factors have changed from the nineteenth to the twenty first century. Infant mortality owes indeed its drop to the rise in the standard of living of the population, and in particular to the improvement of hygienic and sanitary conditions, to the epidemic control, to the spread of most complete diet, to the diffusion of economic well-being. The big drop of infant mortality in Italy, as in the rest of western countries, is due to the control of the exogenous causes (Pozzi, 2002). In most recent periods are endogenous causes prevailing as motives of infantile deaths: the health of the mother, her age and her life style (with reference to the use and abuse of alcohol, drugs, smoking), the presence of genetic diseases or congenital deformities, the prematurity, the difficulties during childbirth. Nevertheless the regional differentials prove that also these factors undergo a strong external influence, since mother or family risk behaviours and difficult access to modern hospitals, specializing in obstetrics and neonatality, concentrate in the poorest areas in the south of the country. This economical and cultural backwardness may explain some regional differences in infant mortality rates still present in Italy, that can be controlled and reduced through specific programs for maternity protection and improving obstetric and pediatric care in the perinatal period.

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Chinese Entrepreneurship in Context: Sector Specialization, Geographical Agglomeration and their Effects on Italian Local Production Systems

Stefania Della Queva, Davide Fardelli, Silvia Lombardi, Franco Lorenzini, Fabio Sforzi

Abstract Chinese migration flows represent a relatively new phenomenon in Italy. Its entrepreneurial nature is reflected in massive flows Chinese businessman employed both in manufacturing and commercial activities, with a dense concentration in correspondence of some industrial districts. The aim of the paper is to shed some light on current Chinese distribution and specialization of economic activities across Italian regions and places (i.e. LLMAs), in order to test interpretative research hypothesis on Chinese entrepreneurship models and identify agglomeration forces underlying the emergence of so-called Chinese ethnic businesses. Some reflections on the manufacturing and commercial attitude of Chinese entrepreneurship will also be considered. The utilization of native-Chinese micro entrepreneurs as unit of observation represents an innovative methodological contribution based on ASIA-ISTAT archives. The exercise of explorative analysis based on data processing and spatial analysis will finally highlight business migration patterns, which represent new socio-economic challenges for Italian local production systems.

Keywords: Chinese Entrepreneurship, Ethnic Businesses, LLMAs.

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1 Geographical pattern of Chinese entrepreneurship in Italy

European evidences on overseas Chinese migration flows show settlement patterns of social communities, which tend to concentrate in metropolitan areas. However, Italian experience reveals further localization evidences, as Chinese communities in Veneto [7] and in Tuscany [6], where ethnic businesses have proliferated over the last two decades. Alongside with the growth of Chinese owned factories is their agglomeration in correspondence to some Italian industrial districts (IDs).The massive outflow of Chinese migrants towards Italy started in the late 1990s. It is acknowledged that the majority of migrants come from a coastal area of China, Zhejiang province, Wenzhou prefecture in particular, which is characterized by specialized industrial clusters at the core of what international economic literature called the *Wenzhou model of development*. Such development model shows many similarities (differences as well) with the model IDs [6]. Some studies [1, 2] provide spatial representations of both foreign communities by nationality and foreign entrepreneurs in Tuscany. However, a nation-wide localization analysis of Chinese entrepreneurs is still lacking, hence denying a proper analysis of settlement patterns of overseas Chinese.

2 Research questions and methodology

The aim of the paper is to shed some light on Chinese specialization and localization of their economic activities in Italy. The unit of the analysis is the Local Labour Market Area (LLMA) [4, 5]. The exercise of explorative analysis aims at detecting localization of Chinese manufacturing activities and business services across different types of LLMAs by utilizing native-Chinese micro-entrepreneurs data provided by 2007 ASIA-ISTAT archives [3]. Research questions addressed in this paper are devoted to understand whether exists an Overseas Chinese model of entrepreneurship, to what extent Chinese ethnic businesses are separated or integrated with local economy, and if the presence of Chinese entrepreneurs in LLMAs producing *Made in Italy* goods provide them any advantage. Data processing has shown that 36.7% of Chinese entrepreneurs in Italy in 2007 carry out manufacturing activities (in particular: 22.6% garment production, 7.2% leather tanning and shoes, 1.1% textile, 1% warp knitting), 47.3% are engaged in retail and wholesale trade, and 12.1% are devoted to accommodation and catering industry. The analysis focuses on garment production[1] (GP). Fig. 1 shows the geography of Chinese entrepreneurs devoted to GP across Italian LLMAs. The degree of Chinese GP vocation within a LLMA is the combination of LLMA GP specialization index (PSI) and endowment index (END) of GP. Analytically,

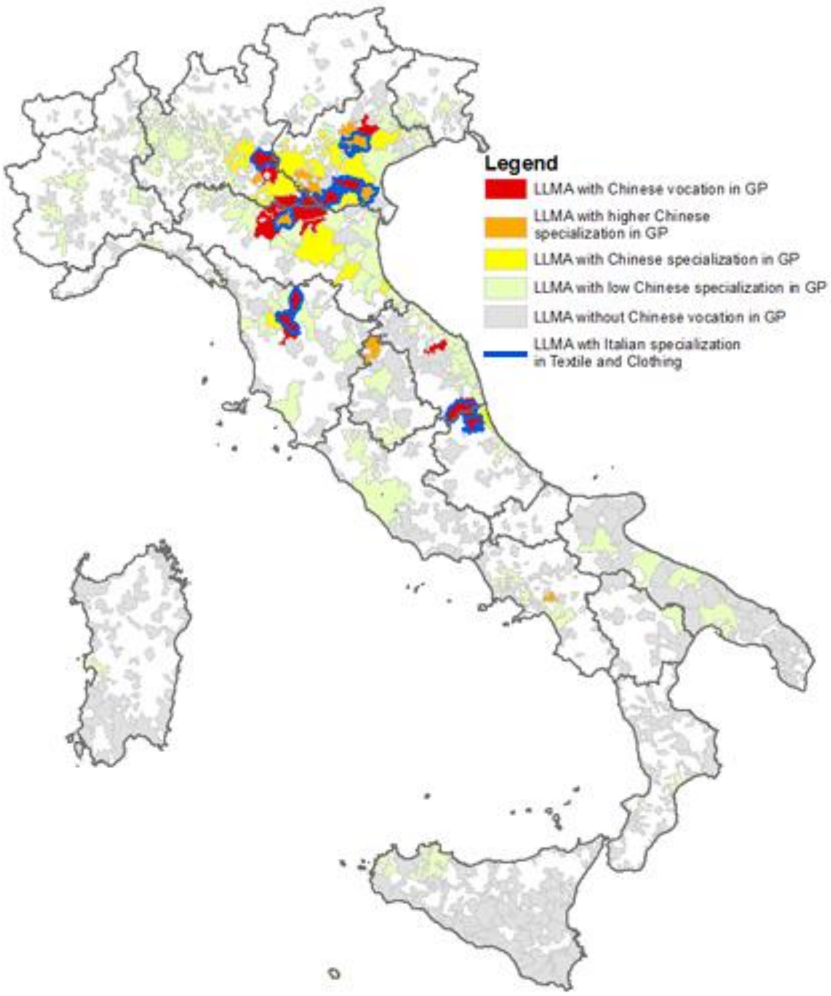
$$PSI_{p,i,j} = \frac{E_{(p=G)(i=C)j} / E_{.(i=C)j}}{E_{(p=G)(i=C).} / E_{(i=C)..}} \text{ and } END_{G,i,j} = \frac{E_{G(i=C)j} / E_{G.j}}{E_{G(i=C).} / E_{G..}}$$

Where p (p = 1,2, … , P) is the economic activity considered (*i.e.* garment in this study), i (i = 1,2, … , I) indicates the nationality of entrepreneurs (E), being C the Chinese nationality, and j (j = 1,2, … , J) is the LLMA where entrepreneurs are

[1] Garment production refers in this study to groups 141 and 142 of NACE Rev. 2.

localized. LLMAs have been attributed different scores according to PSI_j and garment END_j values. Overall, 545 LLMAs (79,4% of all Italian LLMAs) with Chinese entrepreneurs have been classified.

Fig. 1 – LLMAs dominated by Chinese micro-entrepreneurs according to their specialization in garment production (GP) (2007)



Particularly interesting in this analysis are firstly eighteen LLMAs (with highest values of both PSI and END: colored in red in the map). These LLMAs show garment vocation by Chinese micro entrepreneurs. Secondly, nine LLMAs (with highest value of PSI and medium high value of END: colored in orange in the map). The remaining 518 LLMAs show different combinations of lower values of GP specialization and entrepreneurial GP endowment. Among the former two types of LLMAs (colored in red and orange), eleven (40,7%, with a blue circle in the map) are IDs specialized in textile and clothing [5][1]. Chinese micro entrepreneurs engaged in wholesale trade of textile, clothing and leather products does not present high levels of specialization in correspondence of LLMAs with Chinese propensity in garment. In absolute values, wholesale trade of textile, clothing and leather products is mainly concentrated in metropolitan LLMAs of Roma, Napoli, Milano, Firenze, LLMAs corresponding to IDs like Prato and Seregno, non manufacturing LLMAs of Nola, Padova, and Trieste. Notably, only Prato shows high values of both vocation in GP and wholesale traders of textile, clothing and leather products.

3 Conclusions

The focus on Chinese micro entrepreneurs who settle their activities within IDs may be explained by their GP specialization already acquired in China, employment opportunity due to previous presence of Chinese migrant workers (i.e. path dependency and legacy), exploitation of IDs external economies. Chinese micro entrepreneurs who settle their activities outside IDs show anyway proximity to IDs. Alternative variables explaining localization of Chinese entrepreneurs may be connected to social and migration factors, due to residential settlement dynamics of social group (i.e. migration network), and the degree of multi-ethnicity of a LLMA. IDs are challenged by social inclusion and marginalization issues of overseas Chinese community workers. Embeddedness of ethnic business in IDs deals with the effective capability of IDs to absorb extra-local and culturally different workforce. To the extent Chinese entrepreneurs tend to localise outside IDs, socio-economic barriers explain such localization choices. Cross cultural management is the new millennium challenge for IDs.

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[1] In descending order in terms of absolute number of Chinese entrepreneurs are LLMAs of Prato, Empoli, Carpi, Badia Polesine, Poggio Rusco, Castelfranco Veneto, Castiglione delle Stiviere, Ascoli Piceno, Teramo, Este, Adria. All these LLMAs are IDs.

The Italian financial system between 1861 and today: a statistical reading

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Abstract

This work aims at a statistical reading of the Italian financial evolution between 1861 and the recent past. There are lots of scientific works on this argument which are based on Raymond W. Goldsmith's financial indicators (integrated by some other authors such as Ross Levine). These indicators refer to the financial dimension of the economic system (*"financial interrrelations ratio",* FIR); the distinction between the systems bank or market oriented; the incidence of banking system's financial assets (i.e. loans by the banks and by the issuing banks) in comparison with financial markets' assets (i.e. shares and bonds); the comparison between public and private debt; and finally the distinction of companies' debts between shares, bonds and bank's loans.
The statistical series that my work proposes have both important analytic and interpretative aims. Together with the individuation of the age-old topic of the correlation between financial development and economic growth, the aim is that of analyzing if and at what degree the stages of Italian economic growth – where the innovation in economic structure was very important (i.e. railways, large technological systems, and so on) – were accompanied by forms of financial system structure "market oriented", with a high degree of securities placement directly to final investors. While, other stages, when economic growth became routine, were characterized by "bank oriented" financial structures.

1. I contenuti e gli obiettivi del lavoro

In questo lavoro propongo una lettura statistica dell'evoluzione finanziaria italiana tra l'Unificazione nazionale e gli anni più recenti. Esistono numerose analisi dello sviluppo finanziario fondati sull'uso di indicatori statistici formulati inizialmente da Raymond W. Goldsmith (in particolare 1955, 1969 e 1985). Successivamente il dibattito è stato arricchito dalla letteratura che ha guardato ai nessi tra finanza e crescita economica (ad esempio Levine 1997, Demirgüç-Kunt, A. and R. Levine Eds. 2001, Allen and Gale 2001, Rajan and Zingales 2003). Un certo utilizzo di tali indicatori è avvenuto anche nell'analisi dei processi di transizione delle economie dell'Europa del sud-est (Banca d'Italia 2002). Con la crisi finanziaria c'è stata una ripresa d'interesse per l'*"eccessivo peso della finanza"* come possibile determinante della recessione mondiale (ad es., Arcand, Berkes e Panizza 2011).

Gli indicatori sviluppati originariamente da Goldsmith guardano a dimensioni diverse della struttura finanziaria. In questo contributo centreremo l'attenzione soprattutto su quattro aspetti:

a) il rapporto tra lo stock di attività finanziarie dei diversi settori istituzionali rispetto al valore della ricchezza reale dell'economia, il c.d. *"financial interrelations ratio*, FIR");

b) la distinzione tra sistemi finanziari orientati agli intermediari e sistemi orientati ai mercati, spesso approssimata dal rapporto di intermediazione, che confronta le passività delle banche (o di tutti intermediari) con le passività dei settori non creditizi dell'economia;

c) il raffronto tra il debito pubblico (*"dead weight debt"*) e le passività del settore più direttamente produttivo;

d) la ripartizione delle passività delle imprese tra azioni, titoli obbligazionari e prestiti concessi dagli intermediari creditizi (ad es., Della Torre 1990).

Il lavoro è diviso in sette paragrafi. Dopo questa introduzione, il paragrafo 2 presenta una breve rassegna della letteratura. Il paragrafo 3 riassume l'evoluzione di lungo periodo del FIR. Il paragrafo 4 si sofferma sul rapporto di intermediazione creditizia. Il paragrafo 5 guarda al rapporto tra debito pubblico e debito privato. Il paragrafo 6 studia il livello e la composizione del passivo delle imprese. Il paragrafo 7 riporta le conclusioni principali del contributo.

2. Una breve rassegna della letteratura

L'interesse per l'approccio descrittivo *à la* Goldsmith è figlio degli anni '60. In quella fase ci si cominciò a chiedere quali fossero state le ragioni che avevano sostenuto lo sviluppo nel secondo dopoguerra, cercando di spiegarne altresì le diversificazioni tra paesi. Tra questi fattori fu visto il funzionamento del sistema finanziario, che – specialmente in Italia – era meno sviluppato che negli altri paesi sviluppati. Grande fu in questo ambito il contributo degli storici delle istituzioni finanziarie, tra cui sono da menzionare i lavori di Alexander Gerschenkron e Rondo Cameron degli anni '60-70, e l'analisi statistica di Raymond W. Goldsmith (Ciocca 1975, Della Torre 1990). Nello stesso ambito temporale, il lavoro di ricostruzione delle informazioni statistiche in campo finanziario da parte di Goldsmith era finalizzato a individuare linee comuni di sviluppo finanziario nelle esperienze storiche dei paesi evoluti tali da sostenere l'ipotesi di presenza di stadi di sviluppo finanziario *à la* Rostow (Garofalo e Gnesutta 2010).

L'interesse per i legami tra sviluppo finanziario e crescita economica era particolarmente sentito in Banca d'Italia. Accanto ai lavori collettanei curati da Ente Einaudi 1976, Carli 1977 e Vicarelli 1979, nei primi anni '70, con la definizione dei conti finanziari (Ercolani e Cotula 1969, Cotula e Caron 1971), furono costruiti indicatori sulla dimensione e sulla composizione degli stock e dei flussi finanziari per illustrarne l'evoluzione in Italia negli anni 1963-1970. Tra i risultati di questa indagine vi era la considerazione del sistema finanziario italiano come profondamente *"orientato verso gli intermediari"*, con una scarsa vocazione per il capitale azionario ed obbligazionario. In quegli anni i risparmiatori finali manifestarono un'elevata preferenza per la liquidità (depositi bancari), soprattutto dopo la caduta dei corsi delle azioni degli anni 1962-1963.

Più centrati sull'analisi empirica di lungo periodo di stampo secolare tra sviluppo finanziario e crescita reale erano i lavori di Goldsmith e Zecchini 1975 e di Biscaini e Ciocca 1979. I due lavori hanno fornito indicazioni sull'evoluzione della finanza rispetto alla ricchezza reale nazionale e della composizione degli aggregati finanziari per alcune *benchmark dates* (1861, 1881, 1895, ..., 1973), tra l'Unificazione nazionale e gli anni '70 del XX secolo.

Più di recente, in Banca d'Italia è stato posto in essere un progetto di sviluppo dei conti finanziari, che si è concretizzato in un primo volume di definizione del sistema dei conti (Banca d'Italia 2003) e in un secondo volume in cui sono stati raccolti lavori applicati (Banca d'Italia 2008). Da ricordare in quest'ultimo volume il lavoro di Bonci e Coletta 2008 nel quale vengono ricostruiti i dati dei Conti Finanziari dal 1950 al 2004.

3. Il *Financial Interrelations Ratio* e la correlazione con il PIL reale *per capita*

Il *"financial interrelations ratio"* (FIR), introdotto da Goldsmith costituisce un indicatore molto utilizzato in questa tipologia di analisi. Esso è definito come rapporto tra il totale delle passività (attività) finanziarie in circolazione di tutti i settori istituzionali e la ricchezza nazionale (pari allo stock del capitale reale riproducibile (abitazioni, fabbricati, macchinari, autoveicoli, opere pubbliche, ecc.) e non riproducibile (risorse naturali, terreni, ecc.)). L'idea è che la crescita della dimensione quantitativa della finanza sia correlata positivamente con la crescita economica (ad es, il PIL *per capita),* sino al raggiungimento del pieno sviluppo finanziario, individuato da un valore del FIR compreso tra 1 e 1,5[1]

I dati di Goldsmith e Zecchini 1975, ripresi da Biscaini e Ciocca 1979 e aggiornati da Goldsmith 1985, hanno sottolineato la crescita tendenziale delle dimensioni finanziarie dell'economia italiana dai livelli estremamente contenuti del 1861 (con un FIR intorno allo 0.20), propri di una sistema finanziario arretrato, allo 0,47 del 1913 e allo 0,70 del 1939, il drastico ridimensionamento dell'immediato secondo dopoguerra, la forte ripresa degli anni '60-70, sino all'1,16 del 1973, prossimo ai livelli *plafond* correlati con il pieno sviluppo finanziario (vedi fig. 1, serie Goldsmith-Zecchini 1975, per alcune *benchmark dates*).[2]

Per gli anni successivi alla prima crisi petrolifera, la serie elaborata da Bonci e Coletta 2008 nell'ambito del recente progetto sui Conti Finanziari di Banca d'Italia, mostra una pronunciata riduzione delle dimensioni della finanza per tutti gli anni '80, poi un forte innalzamento sino al massimo storico di 1,26 del 2000 (vedi fig. 1, serie Bonci-Coletta 2008, anni 1951-2004). Il livello attuale del FIR è quindi in linea con quelli dei paesi sviluppati (es. Bartiloro *et al.* 2008).

Tuttavia, l'associazione tra dinamica del FIR e del PIL *per capita* è stata giudicata per il periodo 1861-1914 *"vaga e irregolare"*, non risultando confermata l'ipotesi di positiva correlazione tra i due fenomeni, In quanto, nel ventennio che fece seguito all'unificazione nazionale, le dimensioni del sistema bancario crebbero rapidamente, col risultato che il valore del FIR nel 1881 si collocò sopra 1/3. Viceversa, il parametro si incrementò molto lentamente tra il 1881 e il 1914, quando intervenne il grande balzo in avanti (Goldsmith e Zecchini 1975).

Nell'ambito di un progetto sulla dinamica secolare del sistema bancario italiano, ho proposto un'estensione delle informazioni statistiche dei lavori di Goldsmith e Zecchini sopra menzionati, superando i limiti delle *benchmark dates* (vedi fig. 1, serie Della Torre 2000, anni 1861-1914, 1921-1939).

In tale ambito, ho costruito la serie storica per gli anni compresi tra il 1861 e il 1981 dei principali indicatori di Goldsmith e una prima valutazione sulla correlazione tra sviluppo finanziario e PIL *per capita* L'analisi che ne è scaturita rafforza la valutazione critica di Goldsmith e Zecchini e di Biscaini e Ciocca circa l'assenza di una correlazione significativa tra i due indicatori. Gli anni sino alla fine dell'800 vedono la rapida crescita delle attività finanziarie (il FIR cresce da 0,21 del 1861 a valori intorno a 0,70-0,80), mentre il PIL reale *pro capite* (della "vecchia" serie ISTAT-Vitali) (ISTAT 1957, Ercolani 1969, Vitali 1969) resta sui valori del 1861, intorno a 400-450 lire. L'intensificazione finanziaria non si traduce, pertanto, in un concomitante incremento del prodotto reale: la correlazione è negativa (-0,22). Viceversa, gli anni 1898-1914 mostrano valori del FIR livellati sul dato degli anni '90 (da 0,68 del 1890-91 allo 0,72-0,74 del 1913-14), ma alla stabilità del FIR si accompagna il *"grande balzo in avanti":* il PIL *per capita* passa da 400-450 a 600 lire (la correlazione è

[1] Per la connessione positiva e il nesso causale dal polo finanziario a quello reale vedi Levine 1997, e Garofalo e Gnesutta 2011.

[2] Non abbiamo riportato le dinamiche degli anni dei due conflitti mondiali e degli anni che immediatamente seguirono per il loro carattere straordinario.

invece positiva e significativa) (Della Torre 2000, App. 2).

Più di recente, in due lavori redatti con M. Coccìa, V. De Leonardis e M.C. Schisani (Della Torre *et al.* 2006, 2008), ho inserito una revisione per gli anni sino alla prima guerra mondiale della sovrastruttura finanziaria. Più precisamente, ho tenuto conto del fatto che per gran parte dell'800 la sovrastruttura finanziaria "interna" all'economia risultava sovrastimata, poiché parte importante del debito pubblico era detenuto da non residenti e perché il corso della rendita era nettamente sotto la pari per gran parte dell'800 (vedi fig. 1, serie Della Torre *et al.* 2008, anni 1861-1914).

I risultati più interessanti sono stati i seguenti:

a) il livello iniziale del FIR era più basso delle stime sin qui disponibili per l'interazione della detenzione della rendita da parte di non residenti e della valutazione dei titoli ai prezzi di mercato; la differenza tra le due serie del FIR si attenua all'inizio del 900 alla vigilia della "grande conversione" della rendita;

b) il processo di *"financial deepening"* (misurato dal FIR "rivisto") è meno discontinuo di quello sin qui stimato (misurato dal FIR "tradizionale").

c) la rivisitazione del FIR non altera la correlazione con la vecchia serie del PIL di ISTAT-Vitali e continua a evidenziare l'esistenza di due sottoperiodi, mentre le nuove stime del PIL di Fenoaltea 2005 e Malanima 2006 determinano il venire meno del *"carattere vago"* della correlazione finanza – crescita reale (evidenziata da Goldsmith e Zecchini 1975, Biscaini e Ciocca 1979, e Della Torre 2000).

Un inciso per quanto riguarda la fase che seguì l'Unificazione. I bassi valori iniziali del FIR erano propri di un sistema finanziario fondato su "ditte bancarie" e "negozianti-banchieri", che collocavano direttamente valori pubblici presso i risparmiatori finali e scontavano effetti cambiari della clientela. Poiché i dati statistici delle serie bancarie correntemente disponibili (elaborati da De Mattia 1967) fanno riferimento agli istituti di emissione e alle banche di deposito ne segue che viene omessa dal computo l'intermediazione svolta da ditte bancarie e negozianti banchieri. Per cui i livelli di debito delle imprese erano contenuti, e per il basso livello delle azioni in circolazione e dei prestiti delle banche di deposito, ma anche per la mancata rilevazione dello sconto di effetti presso le ditte bancarie. In altri termini, la crescita importante del FIR nel corso dell'800 è l'esito anche del processo di sostituzione da forme arcaiche di intermediazione (le ditte bancarie) a forme più evolute (le banche di deposito) (Della Torre 2000, Della Torre *et al.* 2006, 2008).

Dopo il primo conflitto mondiale[3], ci sono due fasi diverse: gli anni sino al 1939 e il secondo dopoguerra. Nel primo periodo il FIR è in forte crescita, al contrario il prodotto evolve debolmente: il segno dell'equazione è positivo, ma il coefficiente di correlazione è nella sostanza nullo. Soltanto nella fase di crescita del secondo dopoguerra il segno è "giusto" e il coefficiente di correlazione è alto (0,79) (vedi fig. 1, serie Della Torre 2000, anni 1921-1939, e Bonci-Coletta 2008, anni 1951-2004).

4. Il rapporto di intermediazione creditizia

Il rapporto di intermediazione creditizia misura il peso dell'intermediazione in senso stretto con la quale gli intermediari si assumono in proprio i rischi relativi alle passività emesse dai debitori finali: rischi di controparte, di liquidità, di tasso, ecc.. Il parametro è

[3] La serie Della Torre 2000 utilizza, quale denominatore del FIR, per gli anni 1861-1939, una nostra stima della ricchezza nazionale che si discosta da quella (di fonte Banca d'Italia), che abbiamo utilizzato per ponderare i dati finanziari della serie Bonci e Coletta 2008, per gli anni 1951-2004. Le due serie potrebbero avere "livelli" diversi.

definito dal rapporto tra le passività delle istituzioni creditizie rispetto alle passività totali dei settori non creditizi. Ovviamente, nelle situazioni istituzionali in cui gli intermediari creditizi non sono presenti o non assumono posizioni creditorie in proprio verso i debitori finali - svolgono cioè prevalentemente operazioni di *broker* o *dealer* - il rapporto assume valori nulli o minimi. Nel caso contrario in cui il complesso dei titoli primari emessi dai debitori finali è collocato integralmente nei portafogli degli intermediari, il rapporto assume valori intorno all'unità, che costituisce il massimo teorico.

Questo parametro (fig. 2) ha mostrato una crescita continua e consistente dal 1861 (intorno a 0.12) sino al secondo conflitto mondiale (intorno allo 0.60); dopo il ridimensionamento dell'immediato dopoguerra (dovuto al recupero dei valori a prezzi correnti del capitale azionario), l'indicatore si sviluppa enormemente raggiungendo lo 0.84 nel 1973.

Il valore iniziale estremamente contenuto del rapporto di intermediazione era il risultato dell'interazione di: 1. il basso livello delle passività del settore privato, centrate per lo più su azioni e obbligazioni, con livelli estremamente contenuti di finanziamenti delle banche di deposito e degli istituti di emissione (vedi figg. 3-4); 2. la mancata rilevazione degli sconti del portafoglio cambiario delle imprese presso le ditte bancarie e i negozianti banchieri; 3. il debito pubblico, certo molto elevato (vedi fig. 3), era collocato all'estero e colà in parte detenuto e solo in minima parte era nei portafogli delle banche di deposito e degli istituti di emissione; e 4. gli intermediari creditizi, inclusi gli istituti di emissione, avevano un peso contenuto rispetto alle forme arcaiche di intermediazione delle ditte bancarie e dei negozianti banchieri (Della Torre *et al.* 2006, 2008; Della Torre e Schisani 2011).

Con l’esperienza del corso forzoso (1866-1881), il rapporto raddoppia nel giro di pochi anni, per l'espansione delle attività degli istituti di emissione, per poi ritornare ai livelli di partenza con il ripristino della convertibilità metallica. Dopo questa esperienza, la crescita del saggio di intermediazione nei decenni postunitari è trascinata dallo sviluppo bancario, e sino agli anni '30 dalle banche e dagli istituti speciali di credito. A metà degli anni '30, l'intermediazione complessiva conta per più del 60% del debito del settore privato e delle Amministrazioni pubbliche; in tale ambito le banche contano per il 30-40%, gli istituti speciali per il 10-15%, e la Banca d'Italia per il 10%.

Il secondo dopoguerra, dalla metà degli anni '60, è condizionato dalla *“via finanziaria allo sviluppo”*, che porta per ragioni di politica monetaria (*pegging* dei tassi di interesse nella seconda metà degli anni '70, e poi vincolo di portafoglio e massimale sugli impieghi bancari) il valore del parametro vicino ai massimi teorici, con l'assoluta centralità del sistema bancario: 0,68 a fronte di un valore del parametro totale di 0,84, riferito al complesso degli intermediari finanziari.

Dopo il 1990, a seguito dello sviluppo dei fondi di investimento e della riduzione del finanziamento del Tesoro presso la Banca d'Italia si riducono sia il rapporto di intermediazione dell'intero sistema creditizio sia quello riferito al sistema bancario

Il sistema finanziario italiano, caratterizzato da un progressivo *“orientamento verso gli intermediari”* sino al secondo conflitto mondiale e da un secondo dopoguerra con punte del rapporto di intermediazione creditizia prossime al massimo teorico del 100%, ha mostrato dopo gli anni '80 del secolo trascorso una modificazione di struttura, con livelli bassi di intermediazione e quindi *“un orientamento maggiore verso i mercati”* (De Bonis 2008, Bartiloro *et al.* 2008).

Ovviamente questo non significa che sia in atto un effettivo processo di disintermediazione bancaria, semmai di riduzione degli impieghi e dei titoli in portafoglio delle banche e della raccolta sotto forma di depositi: *“la riduzione può essere solo apparente perché le banche controllano gran parte degli intermediari non bancari”* (Ciocca 2000).

5. Debito pubblico e passività del settore privato

Premetto che, per ragioni di omogeneità con la definizione del FIR, il debito pubblico e le passività del settore privato non sono riferiti, come è usuale al PIL ai prezzi correnti, bensì al valore di mercato della ricchezza nazionale (fig. 3).

La serie qui utilizzata del debito pubblico è stata elaborata di recente da Francese e Pace 2008 e costituisce il primo tentativo di costruzione dell'informazione a livello secolare del debito delle Amministrazioni pubbliche, comprensivo delle passività degli enti territoriali.

Per l'800 è evidente la netta "scalata" del debito pubblico sino alla fine del secolo. Tra le due guerre, il debito pubblico cresce molto soprattutto dal 1935, con l'inizio dell'esperienza del circuito dei capitali, le iniziative nell'Africa orientale italiana e la partecipazione alla guerra civile di Spagna.

Interessante notare che le passività del settore privato (inclusive del capitale azionario delle imprese) sono particolarmente contenute sino alla fine dell'800 (intorno al 10% della ricchezza nazionale), e iniziano a manifestare un orientamento alla crescita con i primi anni del '900 e dopo la fine del primo conflitto mondiale (fig. 3, serie Della Torre 2000, anni 1861-1939).

Nell'immediato secondo dopoguerra abbiamo il ridimensionamento in particolare del debito pubblico, ma anche di quello privato. Diversamente dall'800, il secondo dopoguerra vede livelli e dinamica molti consistenti delle passività delle imprese[4] rispetto al debito pubblico. Da notare che il debito delle famiglie (per le quali sono disponibili indicazioni solo per il secondo dopoguerra) non assume un ruolo decisivo (fig. 3, serie Bonci e Coletta 2008, anni 1951-2004).

6. Le passività del settore privato e delle imprese: azioni, obbligazioni, prestiti bancari

Sino al primo conflitto mondiale, il basso livello delle passività finanziarie del settore privato (intorno al 10% della ricchezza nazionale) mostra un livello delle azioni e delle obbligazioni in circolazione di una certa consistenza rispetto ai valori contenuti dei prestiti degli istituti di emissione, delle banche e degli istituti speciali di credito (fig. 4). Tuttavia, affermare che questa fase sia di *"security capitalism"* è avventato, in quanto il debito obbligazionario sembra essere sopravvalutato, soprattutto nei primi decenni dopo l'unificazione. I dati obbligazionari utilizzati, elaborati da Goldsmith e Zecchini 1975, Goldsmith 1985 e De Mattia 1990, sono calcolati sulla base di ipotesi eroiche. Senza dimenticare che si tratta per lo più di obbligazioni ferroviarie, in cui l'azione pubblica fu sempre intensa, anche se talvolta occulta (Della Torre e Schisani 2011).

Tra le due guerre, l'espansione del passivo del settore privato è sorretto dai prestiti delle banche e degli istituti speciali, ma anche dei titoli.

Per il secondo dopoguerra, sono evidenti le fasi cicliche del mercato di borsa (la forte crescita negli anni '50 e la caduta dopo la crisi dei primi anni '60, di nuovo la forte ripresa dalla fine degli anni '70) e la presenza di due momenti diversificati per i prestiti bancari e degli istituti speciali (la forte crescita sino ai primi anni '70 e il netto ridimensionamento nella fase successiva).

Tutto sommato, a fronte di un '800 centrato su pochi debiti, dopo la prima guerra mondiale il finanziamento delle imprese è più ampio e ripartito tra titoli e debiti bancari. La composizione titoli – prestiti non sembra legarsi con le fasi di accumulazione del capitale

[4] Per ragioni di indisponibilità di adeguate informazioni statistiche la serie utilizzata sino alla seconda guerra mondiale è riferita al settore privato, mentre quella per il secondo dopoguerra è articolata tra famiglie e imprese.

produttivo delle imprese (più o meno innovativo e esteso nelle dimensioni). Si tratta di un punto da studiare ulteriormente.

7. Conclusioni

Nei 150 anni dall'unificazione nazionale nel sistema finanziario emergono quattro tendenze principali.

a) L'ispessimento delle strutture finanziarie rispetto alla ricchezza reale dell'intera economia nazionale si manifesta sin dall'unificazione. L'Italia inizia la sua storia con valori estremamente contenuti del FIR, propri di un sistema finanziario arcaico. A una fase di progressiva crescita durante l'800, sino alla "grande conversione" della rendita del 1906, su cui hanno agito forme di sostituzione di assetti arcaici ad assetti moderni degli intermediari, segue la stabilità degli anni '20-30 e l'innalzamento della fase del *"circuito dei capitali"*. Nel secondo dopoguerra, dopo l'azzeramento dei valori reali della ricchezza finanziaria prodotto dalla fiammata inflazionistica, si ha l'incremento continuo del FIR, dal miracolo economico sino alla prima crisi petrolifera. Il *"financial deepening"* prosegue anche nella fase più recente. Attualmente i dati del FIR sono in linea con i valori dei paesi più evoluti.

b) I dati del rapporto di intermediazione vedono la crescita progressiva del rilievo dell'intermediazione creditizia dall'unificazione, con un ulteriore innalzamento nella fase dei vincoli amministrativi introdotti dalla politica monetaria negli anni '70 del Novecento e ridotti nel corso degli anni '80. Da valori intorno al 10% delle passività del settore privato e di quello pubblico del 1861 si arriva a più dell'80% del 1984, al 60 % del 2004. Il sistema sembra, pertanto, evolvere da una struttura "orientata ai mercati", quella iniziale con valori intorno al 10-20%, a una struttura "orientata agli intermediari", con valori tra il 60 e l'80% per il periodo compreso tra gli anni '30 e gli anni '80, sino al ridimensionamento dell'intermediazione più recente, con valori intorno al 60%.

Per l'esistenza al momento dell'unificazione di forme arcaiche di intermediazione (ditte bancarie e negozianti-banchieri) è possibile che lo sviluppo del rapporto di intermediazione sia da attribuire nel corso dell'800, in parte, anche a un qualche processo di sostituzione tra queste forme e quelle più evolute (banche di deposito).

Centrando l'attenzione sul sistema bancario, emergono due risultati. In primo luogo, a prescindere dal periodo del corso forzoso (dal 1866 al 1881) in cui rilevante è l'azione degli istituti di emissione, è possibile attribuire l'ispessimento dell'intermediazione alle banche, sino al secondo conflitto e agli istituti speciali negli anni '20-30. In secondo luogo, dopo la crisi del 1962-63, l'orientamento agli intermediari è tutto sorretto dalle banche, così come il ridimensionamento. Se questo è vero, è probabile che ciò sia effetto anche della fase dei "vincoli amministrativi", della loro introduzione e del graduale abbandono.

c) Ricordando che le serie utilizzate nella valutazione della ricchezza reale nazionale, per gli anni 1861-1939 e 1951-2004, sono metodologicamente diverse, il debito pubblico e il passivo delle imprese (inclusivo del capitale azionario) hanno storie diverse. La *"scalata"* del debito pubblico nel corso dell'800 non trova riscontri, né come livello né come intensità nella parte restante dei 150 anni (ovviamente, escludendo le esperienze delle due guerre mondiali). Dopo il ridimensionamento dei primi anni del secondo dopoguerra, il debito pubblico si colloca stabilmente al di sotto della passività delle imprese. Il passivo delle imprese, dopo i livelli contenuti dell'800, si mantiene con alcune onde cicliche tra il 10 e il 30% della ricchezza reale nazionale.

d) Il passivo delle imprese manifesta una composizione al suo interno molto legata al ciclo della borsa. Peraltro, in alcuni momenti sono evidenti processi di sostituzione tra mezzi propri e prestiti (es., tra la crisi 1962-1963 e i primi anni ’70), in altri processi di complementarità (es., gli anni del primo ‘900 e tra le due guerre). I primi decenni dopo l’unificazione, in cui più elevato è il livello relativo delle azioni e obbligazioni, non configurano un momento di *“security capitalism”*; sono piuttosto l’esito dello scarso rilievo dei prestiti da parte delle banche di deposito e degli istituti di emissione, in un mondo caratterizzato ancora dalla presenza di ditte bancarie e negozianti banchieri (con attività di intermediazione non rilevate).

Per terminare, allo stato dell’elaborazione, mi pare che l’idea di una qualche correlazione tra la composizione tra titoli e prestiti del passivo delle imprese e le forme di accumulazione del capitale reale, più intense e innovative o meno estese e di routine, richieda uno sforzo ulteriore.

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Fig. 1. Il financial interrelations ratio: 1861-2004

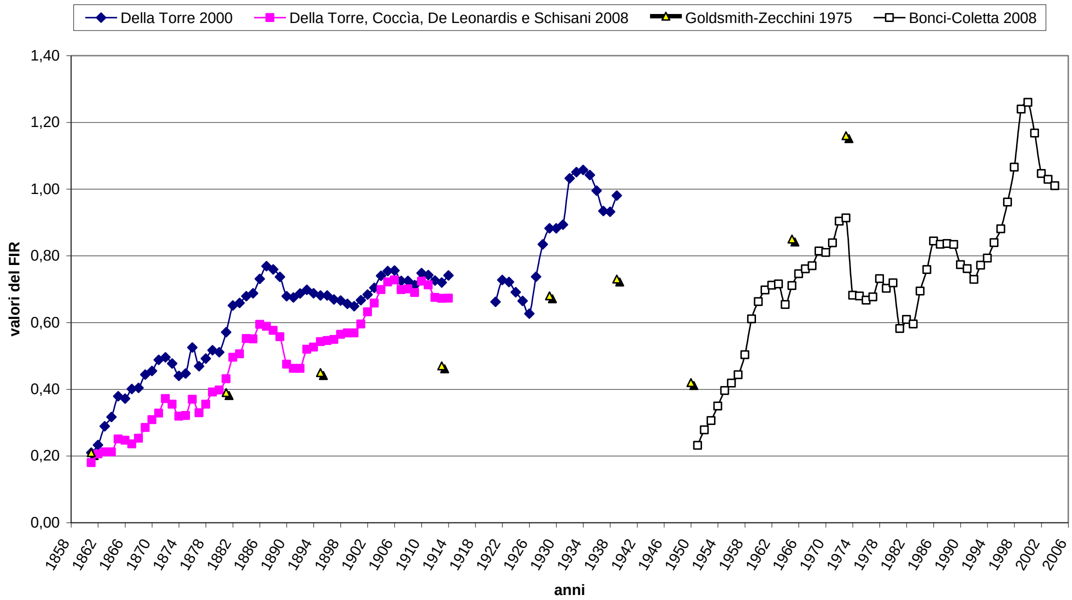


Fig: 2. Il rapporto di intermediazione creditizia, 1861-2004

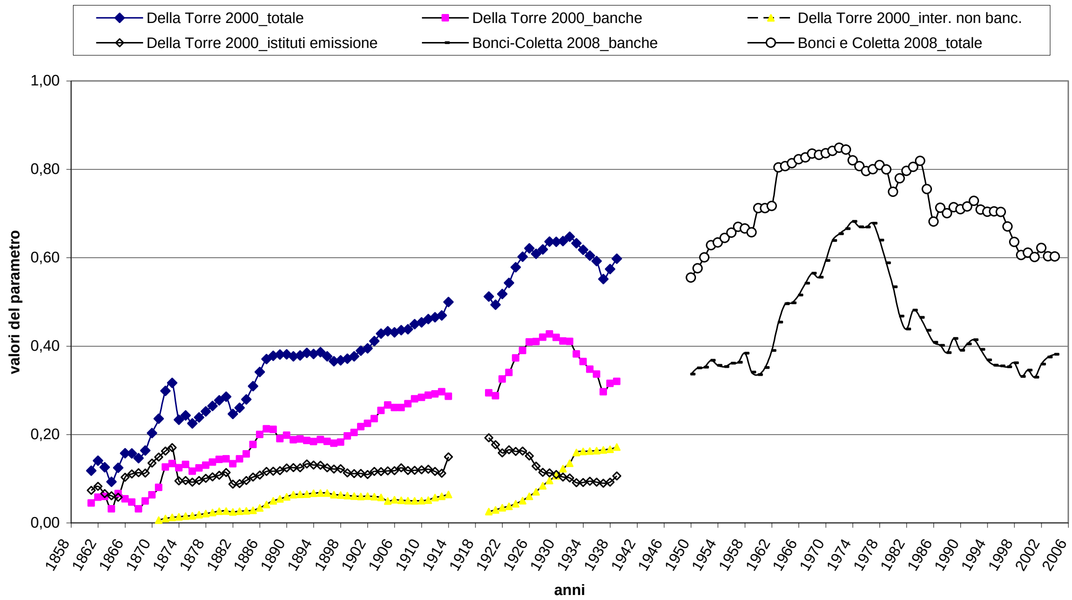


Fig. 3. Debito pubblico e passività del settore privato sulla ricchezza reale, 1861-2004

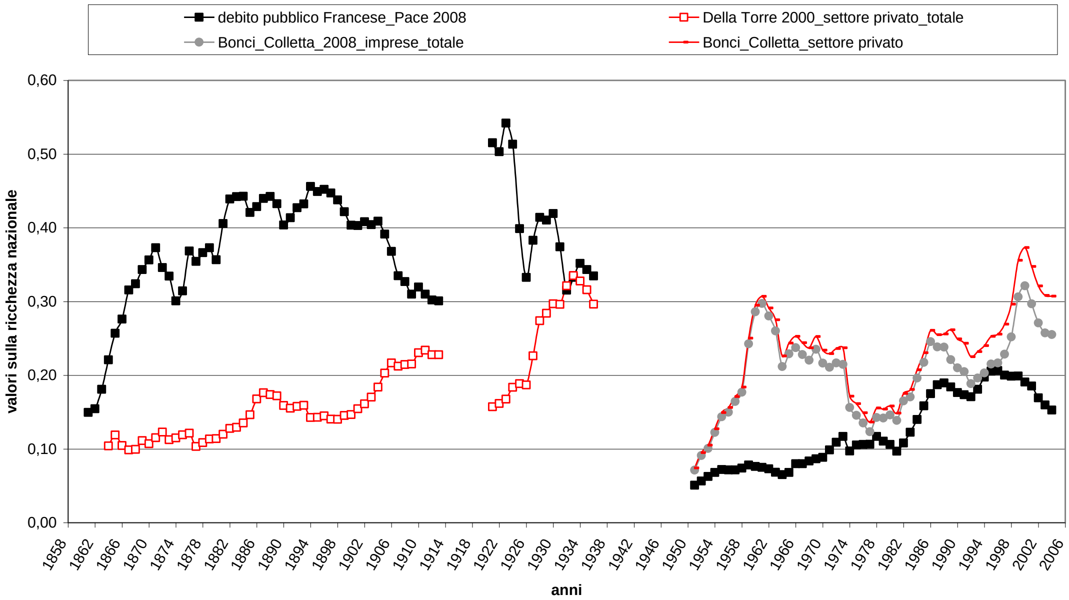
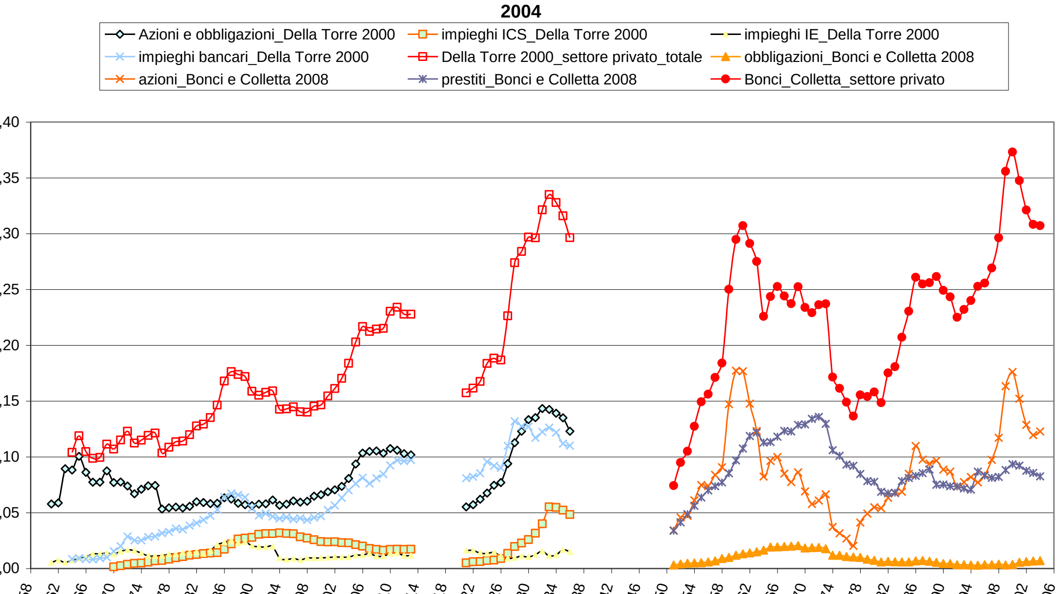


Fig. 4. Passivo delle imprese: azioni e obbligazioni, prestiti sulla ricchezza reale nazionale, 1861-2004



The Italians abroad after Unification. The analysis of emigration in Brazil through money flows data sources

Alessandra De Rose and Donatella Strangio

Abstract Between 1961 and 1985 more than 1,400 thousand Italians left the country towards Brazil and there produced a great amount of wealth, part of which had been remitted in Italy. In this paper we will concentrate on the main estimate of the financial flows through the study of official sources and try to take information from various data sources, and provide an evaluation of figures relative to the years between Unification and 1910, a period highly important for the Italian emigration to Brazil.

Key words: Emigration, Remittances, Brazil

1 Figures of the Italian "exodus"

The Italians have been the protagonists of the more massive "exodus" in contemporary history. In the 100 years run after Unification more than 24 million people left the Country [10]. Every region of Italy had been interested by the phenomenon, though in different periods of time. Between 1876 and 1900, 59% of the flows came from the Northern regions, namely Veneto, Friuli Venezia Giulia and Piemonte; at beginning of '900 the situation inverted and the more paying regions became Sicilia, Campania and the other Southern regions. Between the two World Wars the flows were more equally distributed

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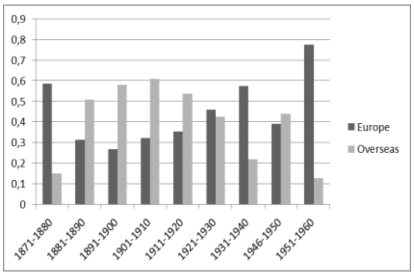
between South and North, while after 1945 the majority of emigrants left from the Southern part of the Country (53%).

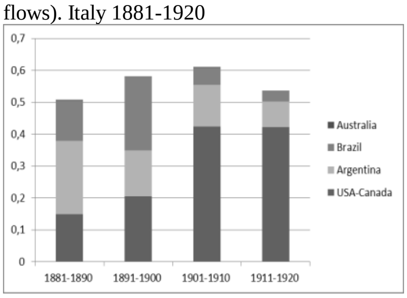
As to the direction of the flows, figure 1 shows the different role played through time by Europe (namely France, Germany and Switzerland) and overseas lands (namely North America, Argentina, Brazil and Australia) as destination of the Italian emigrants.

Figure 1: Emigration flows to Europe and Overseas (%) . Italy 1871-1960



Source: Our elaboration on ISTAT [7]

Figure 2: Emigration flows specific overseas destinations (% out of total flows). Italy 1881-1920



Between 1881 and 1920, overseas emigration prevailed. In Figure 2 a focus on that period is proposed, showing the flows by main countries of destination.

2 The case of Brazil

The first arrivals of Italians in Brazil date 1936: it has been estimated that at the end of the century more than 1.5 million Italians reached the country [5].

In the last decade of the XIX century, Brazil became the prevailing destination for Italian emigrants. The main factor for the flows to increase was the abolition of slavery in 1888. Already since 1850 a series of laws had made it more difficult to use slaves for the plantation, just when the great success of the coffee market induced a significant expansion of its cultivation. The colonization of the vast and unkind territory of Brazil and deforestation were other strategic Government’s objectives. Immigration was, therefore, actively promoted mainly in Europe, namely Germany and the North of Italy: white-skin people and with a peasant experience were highly welcome [9]. In the early eighties of the nineteenth century was launched the so-called "subsidized emigration" on a national scale, which included free transportation of migrants at the expense of the Brazilian Federal Government.

The Italian peasants arrived in Brazil after the Germans, mainly in the South of the country, namely in the areas of Holy Spirit, Rio Grande do Sul and Santa Caterina, where the colonial nuclei assigned to them were the most forester regions, the less fertile, with very poor ways of communication and without any medical care or religious services. In St. Paul, called "Italian city", migrants joint the newly born industry, and the Italians represented the majority of total foreign workers [5].

The conditions of work and life were, however, very unpleasant and proved to be so severe as to induce many Italians to return and push our Government to ban subsidized emigration toward Brazil in 1902 by a decree (*Prinetti Decree*). After that, the number of Italian emigrants to Brazil sharply decreased also as an effect of a cyclical downturn of the coffee production [9].

3 The economic evaluation of the emigration experience: the role of the remittances

A quantification of the phenomenon from an economic standpoint is rather difficult. A main problem is that the Italian immigrants entrusted only a portion of their savings to the formal transfer channels. Other ways of sending money, considered as more comfortable and less expensive, although much less documentable, were: the shipment in an envelope by mail, registered or insured cash as the tickets by the Italian State or by the Italian banks of issue or insured bank checks [6]; delivery through relatives and friends who returned; transported by themselves when coming back; or by the services offered by some private bankers. Many scholars have sought to provide a reliable estimate of these flows through the study of official sources and the estimation of the not-traced component. It has been estimated that, in the years following Unification and before 1910, most of the money flows from migrants (50-55% out of the total) passed through official channels, while between 20% and 30% passed through the informal ones.

The postal system of the new Kingdom of Italy offered three kinds of security to customers for the transfer of migrant remittances: international money orders, money orders and payments consular post in the savings banks.
The international money order service has been granted by the Italian post office since 1862 but it was not readily available until the end of the century. In America, for instance, it was very rarely used; in Brazil the service was completely lacking [6], whereas the use of international money orders was common among immigrants in Europe [2]. According to data published by the General Commissioner for Migration, 76% of the total number of money order between 1901 and 1925 came from continental Europe; 27% from USA and Canada and only 1% from other countries [3].

The Law 2779/1875 established the postal savings banks system, linked to the postal system [4]. The savings put into storage in the new postal system increased over the first decade from 2 to 200 million at current prices [8]. The postal savings operations on behalf of Italians living abroad, established in 1890, grew rapidly, from an initial amount of about 87,000 lire in 1860 to 15 million in 1900 and rose to 107 million in 1910, to two billion and 600 million in 1920 and almost 3 billion and 700 million in 1925.

As to the banking system, it must had appeared to our migrants as a variegated world, managed by few actors (private bankers or "countermen") most of whom Italian themselves, engaged in business enterprises without any control by public authorities or private companies. The survey "Immigrant banks" held by the U.S. Commission on Immigration, submitted to the Congress in 1910, shows that in a sample of 116 Immigrant Banks (of which 47 Italian) only one was involved exclusively in banking business, while, among the remaining 115, 8 were also shipping companies.

At the end of the nineteenth century the problems that plagued the Italian immigrants were known and there was also awareness that the cash flows related to migration were significant. In 1901, on a proposal by Luigi Luzzati, a law was approved that mandated the Bank of Naples (one of the three issuing banks) to pay special attention to this task.

The success was only partial, and the Bank of Naples came to mediate a very small proportion (13.5%) of total remittances. In the period 1902-1925 just under 6 billion current lire had been intermediated, 83% came from the United States alone, 14% from South America (almost entirely from Argentina and Brazil), 3% from Canada and only 0.2% from Europe (almost all from Germany). In 1910 the Bank of Italy promoted a survey among the entire Italian banking system referred to the year 1909 [1]. It gives a picture of how the collection was organized through the banking at the end of the first decade of the twentieth century [10].

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The Survey Design for a New Survey on Homeless Population

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Abstract The traditional poverty estimates normally refer to the population living in private households and do not take into account the most extreme forms of poverty. The new survey on the homeless population wants to give a representation of the dimension of the homelessness phenomenon, and of the formal and informal services, both public and private, potentially able to meet the homeless people needs. An "indirect sampling" has been used, based on a sampling frame, represented by the services, indirectly related to the target population and the estimation approach is the "weight share method", based on the links connecting the frame of services with the population of homeless.

1 Introduction

The traditional and the new measures recently released by Istat in terms of poverty estimation are based on the population living in private households. The population registers are used as framework for the household surveys; as direct consequence, homeless population is not covered, even in the case when some homeless are registered in the municipality population list (they have no probability of inclusion since they cannot be found at their formal residence). Therefore, the most extreme forms of poverty are neglected by the official estimates and a homeless survey needs new and different methodological approaches finalized to get information on this population of which even the size is unknown.

Two principal approaches characterise the internationally conducted experiences (Edgar, Harrison, Watson and Busch-Geertsema, 2007): i) a full counting of people

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sleeping on street and shelters during a prefixed night (S-night approach); ii) an indirect estimation of the homeless population through the information collected at the service providers. The first method allows the census of the homeless population but it can produce an underestimation, in some cases also relevant, due to people hiding themselves or living in places difficult or dangerous to reach. Moreover, such a census is very expensive in term of fieldwork that has to be wide and effective in order to cover all the territory in one single night. The second approach is more feasible and seems to be more appropriate for a country wide homelessness estimation, with the aim of surveying also some socio-economic characteristics of the homeless people. In this case, it is possible to resort to the theory of indirect sampling (Lavallée, 2007), using a sampling frame, represented by the service providers, indirectly related to the target population; consequently the target population is restricted to the people using services.

2 The Italian Survey

With the aim of following the second approach, in 2009 Istat (together with the Welfare Ministry, the Italian Federation of Organizations for the Homeless -Fio.PSD- and the Italian Caritas) decided to conduct a new survey, by reaching and interviewing the homeless population at the places providing services potentially addressed to them (Grassi, Pannuzi and Siciliani, 2010).

Because the homelessness phenomenon is mainly spread in the wider cities, the interest territory has been restricted to the municipalities with more than 70,000 inhabitants, the provincial capitals with more than 30,000 inhabitants, and the municipalities with more than 30,000 inhabitants bordering on the municipalities with more than 250,000 inhabitants (for a total of 158 municipalities). A census of services providers for homeless people in the selected municipalities has been conducted, with special attention to soup kitchens and night shelters that represent the places with the highest probability of finding homeless people. The map of – formal or informal, public or private - services to homeless people has been obtained through: i) the list of the organizations contained in the pre-existing Istat, Caritas and fio.PSD databases; ii) a CATI survey on those organizations, to validate the data, using a "snowball" technique in order to find new organizations, directly or indirectly, which provide homeless services and iii) a CAPI survey among the organizations which directly provide services, in order to obtain key information - daily services, number of users and homeless users, opening days and time - for the final phase, represented by the direct interviews to homeless people.

Istat has released the preliminary results (Istat, 2010), referred to 31 municipalities (where, at that time, the CAPI survey on all organisations providing soup kitchens and night shelters services were ended and where the non response rate for the other services where lower than 10%) and the 115 organisations directly providing services devoted to homeless people. The 79% of the organisations were private; in two out of three municipalities the services were provided both by public and private organizations. One third of the services provided primary needs, among them the 21.4% were soup kitchens, and almost 16% were night shelters services.

The list of the soup kitchens and night shelters in the selected territory represents the sampling frame for the target population and also the places where the interview to the selected units can be conducted. The field operations for this phase will be put in practice during the year 2011. The users of the considered services are people in economic difficulty, not only homeless people and this aspect must necessarily be taken into account. Moreover, in order to cover the target population, the survey time period has to be long enough to ensure that most homeless people uses services at least once: one month has been proved to be a good choice (Ardilly and Leblanc, 2001). Finally, in order to obtain an unbiased estimate, it is necessary to consider the fact that, in the survey period, a single person can apply to several centres and therefore the multiple counting is real risk and has to be evaluated.

3 The Sampling Strategy Based on Indirect Sampling

The approach of indirect sampling is useful when a sampling frame of the target population, U^A, is not available, but it is possible to use a list referred to a different population, U^B, related to the target one. The sampling strategy consists in selecting a sample from U^B and in producing the estimation of the parameters referred to U^A taking into account the links between the two populations. In the context of the homeless survey, U^A units are homeless persons who receive at least one service during a defined period of time, while U^B units are the services provided to persons in the considered centres during the same period of time; hence, services are the sampling units through which persons can be reached, given the one-to-one correspondence between the two populations in a specific point of time, during which a person could not receive two different services. The list of centres providing services is the sampling frame, being each centre a cluster of services, and the sampling units are the triplets (centre, point of time, service). The points of time are defined as a specific lunch time or dinner time for centres providing meals and a specific night for those providing accommodation.

The most relevant parameter of interest defined on the target population is its unknown size N , together with some other parameters referred to characteristics of the homeless persons. In the indirect sampling framework, the definition of the estimator is more complex than in the general case of the sampling theory, because the calculus of sampling weights focuses on the relationships between the units from the sampling frame and those ones from the target population. To assign a sampling weight to each interviewed person, it is necessary starting from the weight of the sampled services, adopting the estimation method known as *weight sharing method* (Lavallée, 2007).

As the sampling weights of the visited centres are involved in the calculus of the individual weight, to ensure a correct sharing of the weights, the map of the links between persons and centres has to be known: for a fixed period of time and for each interviewed person, the lists of all visited centres have to be collected.

In this survey, the length of the reference period has been set in a week, so that the estimate of the links refers to an average week. This choice seems to be the most appropriate to obtain reliable answers to retrospective questions (a longer period of time heavily increases the probability of imprecise or incorrect information). The instrument, to collect all the information to map the links, is a daily diary in which is written where the person ate and slept in the 7 days preceding the interview. The survey selection scheme includes all the soup kitchens and night shelters, according to the results of the CAPI survey, being their number too small to give reason for a sample selection. In this way, a one stage stratified random sampling design is defined, each centre representing a stratum. Therefore, the selection concerns both the time dimension and the centres users: each centre has to be visited in a prefixed time, randomly selected in the 30 days reference period; for each selected couple (time-centre), the interviewer has to select randomly a predefined, in terms of size, sample of persons among the centre users. To calculate the sampling fraction, the interviewer should know in advance the number of persons receiving a service in the centre. As this quantity is unknown, the information collected in the CAPI survey is used as an expected value. The amount of these people is registered at the end of the interviews, in order to calculate the exact inclusion probabilities of the interviewed persons.

An evaluation of the expected sampling error for the estimate of the population size N has been obtained on the basis of the information collected in the CAPI survey with regard to the centres - total number of services provided in one month and quota of homeless among total users - and for several sample sizes. The variance of the weight share method estimator depends on the variability of the number of links (Lavallée, 2007). As the homeless phenomenon is completely unknown, the evaluation of the sampling variance has been obtained assuming a pessimistic distribution of the number of links: for a given mean of the weekly number of individual links**,** L, the maximum variance distribution has been used. This evaluation has been carried out varying L in the range of the possible values (from 1 to 21). To summarise the results of this estimation: with a sample size of 3**,**500 interviews and different L values (from 5 to 19), the relative sampling error of the N estimate ranges from 3.2% to 2.5%; with a sample size of 7**,**000**,** it ranges from 2.2% to 1.8%; in both cases the maximum of the sampling error is found in correspondence of the value 11 of the mean of the individual links number. So, not only the estimate of N depends on the number of links (expressing the dimension of the attendance of the homeless in the centres), but also its sampling error.

The survey described in this paper represents an important innovation for the official statistics for two main reasons: the homeless population is surveyed at national level for the first time on the whole Italian territory; a new methodological instrument, such as the indirect sampling, is experimented for a large scale survey. This experience will constitute the basis for further improvements in the exploiting of this methodology.

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The Sixth Agriculture Census 2010: from Survey to Provisional Data

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Abstract The need for promptly monitoring a large data amount requires the use of statistical and IT tools. For the 6th General Agricultural Census, the National Institute of Statistics (Istat) has adopted, for the first time, a Census Management System (SGR) which allows, among other things, also implementation and, then, table analysis with data collected by online or paper questionnaire. Specifically, it's possible to analyze trend and results of the survey at regional and/or subregional level. As concern survey trend, it's possible: i. to monitor the amount of agricultural holdings included in SGR; ii. to get reports on the status of processing the questionnaire; iii. to show information on units which have overcome the check phase. Moreover, SGR allows the implementation of summary tables on the collection progress results by detected, not detected and inexistent holdings. These tables will allow comparisons with other variables as: Regional Archives, Special Lists, Eligibility and Total Surface classes of the *precensus* list. The main aim of the present study is tables analysis and implementation of appropriate indicators that will allow the identification of criticality and thus the formulation of better management strategy. In this way, it will be possible: i. to identify areas and/or phases of the survey which could be critical; ii. to adopt corrective measures acting on each single operator of the network and/or on territorial criticality. Moreover, for spatial and/or temporal analyses, some indicators useful for comparison, understanding and discussion of survey results will be calculated.

Keywords: Monitoring, 6th General Agricultural Census, SGR, Indicators.

1. Introduction

The Census of Agriculture 2010 is a part of the agricultural census to be conducted in all EU member states and of the worldwide agricultural censuses provided for by the United Nations Food and Agriculture Organization (FAO) for 2010. With that survey, Italy meets the European Union requirements to be fulfilled by a comprehensive agricultural census as laid down in Regulation (EC) n. 1166/2008 of the European Community [1]. The Agricultural Census 2010 markedly differs from previous censuses in many aspects, both in terms of content and use of statistical and IT tools. Istat has adopted, for the first time, a Census Management System (SGR) which takes into account: a) 20 different regional plans; b) more than 15.000 operators and more than 2.000.000 holders of Agricultural holdings (unit)[2]; c) a "new" territorial hierarchy; d) a

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[2] About 60% of Agricultural holdings in the *precensus* list is concentrated in Puglia (14,9%), in Sicilia (12,8%), in Campania (8,5%), in Calabria (7,7%), in Veneto (7,5%) and in Lazio (7,2%).

large network with different roles assigned to the operators; e) two different model to carry out the survey: High level participation and Integrative participation[3] [2].

2. Data collection and processing

Census data collection both for online (by agricultural holders) and paper questionnaire (by operators) started October 25th, 2010 and it is still going on with different regional deadlines. Once collected, data from paper questionnaire are processed in SGR by operators through two functions: Result registration (whenever the unit has answered or not) and Data entry (for High level participation Regions only) [3]. Data must be validated by internal and external check phases after their input, both for online and for paper forms. This paper deals with data which have overcame the internal check phases, while the external check phases are carrying on till now [2].

At the moment (February 21st, 2011), the number of questionnaires which have overcome the internal check (*vs* total number of filled ones) at regional *versus* national level are showed in the Table 1. Total national number of questionnaires is 1.535.250 and represents around the 72% of the total number of 'check ok' questionnaires *vs* total number of filled ones (result registration by operators *plus* online submission by holders). At regional level, this percentage vary from a *minimum* of 37,3% (Valle D'Aosta) to a *maximum* of 97,3% (Puglia). All Regions with Integrative participation model (including Molise), have a percentage greater than 90%. In fact, for these Regions, the model establishes the end of data registration to February 21st, 2011 (respect to the March 31st, 2011 for the other Regions) and a faster procedure for data collecting.

Table 1: Regional distribution of 'check ok' questionnaires

REGIONS	% Check ok questionaires vs total numbers of filled ones	Devation from national mean
PIEMONTE	62,02	
VALLE D'AOSTA	37,31	
LOMBARDIA	63,29	
VENETO	97,25	
FRIULI VENEZIA GIULIA	67,98	
LIGURIA	78,28	
EMILIA ROMAGNA	46,59	
TOSCANA	95,57	
UMBRIA	44,97	
MARCHE	94,81	
LAZIO	50,81	
ABRUZZO	39,71	
MOLISE	94,45	
CAMPANIA	82,88	
PUGLIA	97,29	
BASILICATA	81,80	
CALABRIA	48,41	
SICILIA	69,02	
SARDEGNA	54,43	
BOLZANO	82,11	
TRENTO	44,34	
ITALIA	**72,76**	

[3] *High level participation model*: the 16 Regions which choose this model define the census network within its area and carry out the entire process (through the data entry and check functions). *Integrative participation model:* the 4 Regions (Puglia, Marche, Toscana and Veneto) which choose this model carry out more limited tasks since Istat is in charge of the organisation. The municipalities conduct the field operations and manage the census network; data entry will be limited to primary variables only (aggregate information on crops and livestock). Molise chooses high level model but Istat is in charge of data entry [1].

SGR allows the visualization of summary reports on collection progress. The summary reports contain information on phases of the survey by territorial level.

Figure 1 and Figure 2 show, for the first and the last period of our analysis[4] (January 10th, 2011 and February 21st, 2011), how each Region differs from the corresponding national average for two indicators: the ratio of 'check ok' questionnaires *vs* the total number of filled ones (y axis) and the ratio of the numbers of filled questionnaires *vs* the number of questionnaires assigned to operators (x axis)[5].

Figure 1 shows, in the Ist quadrant, the situation where these indicators are greater than the corresponding national data: Liguria and Bolzano. With respect to the corresponding national data, in the IInd quadrant there are the Regions with a positive situation for the 'check ok' phase, but with a lower value for the filled questionnaires. In this quadrant, it's possible to identify two groups. The first group (Friuli Venezia Giulia, Lombardia and Piemonte) has a higher value for both indicators respect to the second group (Sicilia and Valle D'Aosta). In the IIIrd quadrant, there are the Regions with a more critical situation (with a low value for both indicators). In this case, the Region with the worst value is Lazio where the census operations are begun later respect to the other Regions. In the IVth quadrant, there are the Regions with a higher value for filled questionnaires and a lower value for the 'check ok' (respect to the national average). In this quadrant there are the Regions with the Integrative participation model: in particular Veneto with the better value for the filled questionnaires and Puglia with the worst value for 'check ok'.

The situation to the last period of our analysis (Figure 2), shows more Regions in the Ist quadrant. In fact, one can find in the Ist quadrant the Regions with the integrative participation model (that have finished the data registration) in addition to Bolzano, Basilicata and Campania. In the IInd quadrant, Sicilia and Liguria must to finish quickly the result registration. In the IIIrd quadrant, the census operations remain critical for Lazio and Valle D'Aosta. Five Regions have value lower than 5 percentage points (always respect to the national average) for the filled questionnaires, and lower than 33 percentage points for 'check ok'. In the IVth quadrant there are Trento, Emilia Romagna, Calabria and Piemonte.

[4] We have chosen these two periods because in the January 10th 2011, the threshold of filled questionnaires has been over 50%, and the February 21st, 2011 because the Regions with integrative participation model have finished the data registration in SGR only for the primary variables.

[5] For the census data collection in SGR, all the questionnaires must be associated to operators before beginning the census operations.

Figure 1: Overview on January 10th 2011 of result registration and ‘check ok’ questionnaires

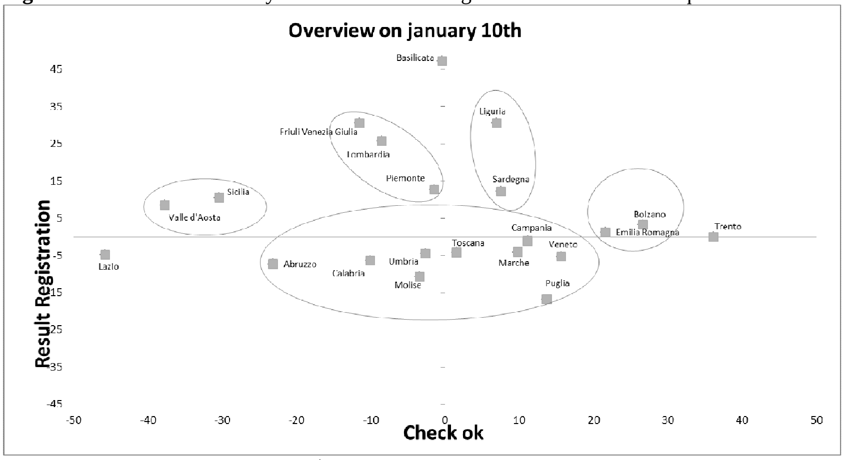
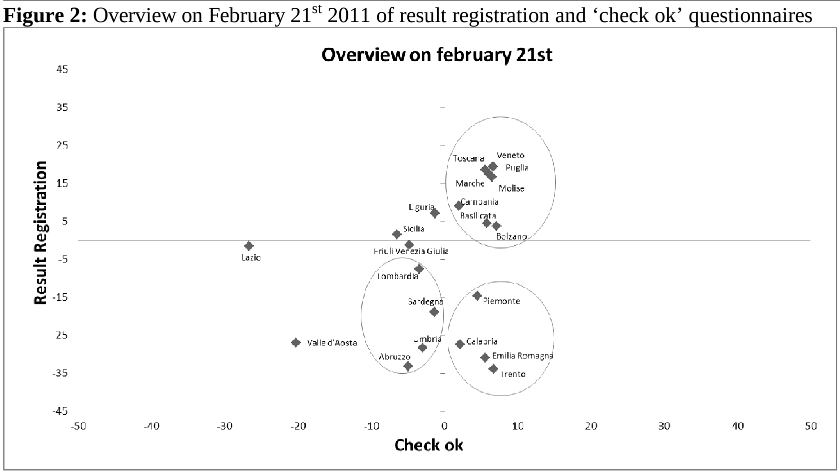


Figure 2: Overview on February 21st 2011 of result registration and ‘check ok’ questionnaires



3. Conclusions

In this paper we deal with the comparison between the territorial data taken in different phases of the survey. In doing this, we provide a clustering of the Italian Regions with respect to their behaviours. This issue has been analyzed by introducing appropriate indicators, which are based on the data generated by SRG. A SRG-based monitoring activity on the survey has been performed as well.

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Micro data archives in educational measurement

Patrizia Falzetti and Roberto Ricci

Abstract During the last decade the National Evaluation Institute for the Educational System (INVALSI) has realized several student outcomes surveys on some key competences. The survey results provide a large amount of data that can be used at several levels. INVALSI intends to contribute to the dissemination of micro data and make them available to the research community and stakeholders. INVALSI uses also a detection method to clean the data from students and teachers cheating. During the last years a too strict interpretation of the privacy laws has limited several research opportunities. In this paper we illustrate how to handle individual data and find a balance between the limitation imposed by the law and the necessity to realize and promote research about the educational outcomes. INVALSI has also developed an open system to get aggregated and micro data, including social, cultural and economic covariates, in full observance of the privacy law. With the aim to enlarge the knowledge about the most relevant changes of our educational system, INVALSI is working on the possibility of anchoring the measurement scales of different surveys and linking the outcomes of each student, in order to open a longitudinal research perspective.

1 Introduction

Several developed countries has reacted to the urgency of improving public schooling with a national evaluation service, able to measure the student achievement level in the main skill areas. In this sense, Italy is not an exception and it has organized a National Evaluation Service (NES) with the explicit aim to measure the proficiency level of its students in two main contents: reading comprehension and mathematics. After an experimental period that embraces the first six-seven years of the new millennium, Italy has established the NES to accomplish its main goals during the

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current school year. The current structure of NES is based on a yearly census survey in five school grades: second, fifth, sixth, eighth, and tenth grade.

In order to realize the above mentioned goals, the National Institute for the Evaluation of Educational System (INVALSI) adopted several technical and strategic measures, that are able to face crucial issues for a robust, reliable, and informative assessment in Education. As seen also in international surveys (OECD-PISA, IEA-TIMSS, and so on), the measurement of basic skills is extremely relevant to depict the capability of an educational national system to ensure to its youth adequate economic and cultural growth. Besides, INVALSI is responsible for the Italian participation to these surveys (OECD-PISA, IEA-TIMSS, IEA-PIRLS). Therefore, it is possible to promote a contamination, concerning both the methodology and the goal, between international surveys and NES. In the next future it will be possible to link the results of the different researches in order to enlarge the knowledge about the Italian educational system in a international perspective, as well. Currently, NES uses several methodologies already implemented by PISA. This allows a major robustness of NES data and it makes easier, to the community of users, the interpretation of data and analyses published by INVALSI.

As usual in this research context, INVALSI has started by defining an evaluation framework. This document plays a key role in order to define goals, characteristics, and limits of NES. For the Italian context the definition of a public evaluation framework was quite unusual until some years ago, although it is extremely important to give sense to analyses based on data of standardized tests.

In this general context, during the last years, INVALSI has realized surveys based on standardized tests administered to millions of students. In the last school years, the participation of all the students attending second, fifth, sixth, and eighth grades to the national testing organized by INVALSI, was compulsory.

2 Data on Education

The large scale surveys realized by INVALSI in the last decades make available for the whole community a great amount of data, that can contribute to promote scientific research on the Italian school system. The availability of robust data on educational system is extremely relevant for the advancement of scientific knowledge on a wide variety of mechanisms that influence, sometimes in an implicit way, individual and general outcomes.

Until last years, Italy suffered lack of data that are able to give information on educational achievement based on comparable and standardized tests. This problem is probably one of the elements that causes the lack of scientific research about the school system (Bottani, 2003). In this sense, the NES could be a possible answer, obviously not the only one, to the high demand for data that can be analyzed to understand the different factors that influence school outcomes.

Starting from 2008 INVALSI has began a new communication policy in order to facilitate the dissemination of micro (student level) and aggregated data among large community of stakeholders. The large diffusion of micro and aggregated data poses several issues to be faced in order to fulfil the aim to give the stakeholders and the scientific community meaningful information and, at the same time, to respect restriction and limitation posed by the law. This latter aspect has several implication that has to be carefully taken into account.

2.1 Cautions about data protection

Data protection is not only a legal issue. The basis of the strategic trust relationship between the schools and INVALSI is the absolute reservedness of data. In this initial phase of NES is very important that schools are pretty sure that their individual data (disaggregate by student and by class) are not disseminated. In this way the schools, or the majority of them, are inclined to participate *honestly* to NES because they understand the value and the benefits of data, correctly obtained.

Obviously, the above described school concerns are particularly relevant in this early phase of NES. However, these concerns should be taken seriously into account when NES will be a stable immaterial infrastructure. Indeed, an easier dissemination of micro data, at school or even at student level, could divert the attention from the student achievement tests to the evaluation of school performance. This latter aspect has many implications. Too much emphasis on achievement test results could lead some schools to act dishonestly, modifying the results of their students (see paragraph 2.2).

Furthermore, the easy availability of school and student level data may cause other drawbacks, probably more dangerous than those ones of students and teachers cheating. Indeed, if the test results are used to evaluate the school performance, this will inevitably lead the schools to fit their curriculum to the tests. That is, the so called teaching to the test could be somehow encouraged. As well known, school evaluation requires the availability of a large amount of data, not only in the area of student achievement. The school performance, in fact, is strongly influenced by different covariates (social background of students, availability of financial resources, quality of teachers, and so on) that should be taken into account for an accurately school performance evaluation.

2.2 Data cleaning: cheating detection and removal

As mentioned in the previous paragraph, the school participation in census based survey like NES poses several issues to deal with. At first, it is quite common that some schools do not accept or understand the goals of a national measurement, especially if these goals are not clearly explained. In these cases it is possible that some schools or teachers fear that in some way the assessment is on their work and not on students. Of course, this perception might generate defensive behaviours that in some cases can even lead to cheating phenomena.

As clearly shown in the literature, cheating behaviours are quite common in census based surveys (Jacob and Levitt, 2003). Unfortunately, Italy is not an exception. Cheating behaviours are obviously a relevant threat for a significative data use. Therefore, it is extremely important to look for statistical tools and methods to reduce the impact of the bias produced by cheating phenomena.

In the last three years, INVALSI has adopted a new method based on outlier analysis (Quintano et al., 2009). In a large sense, outliers are usually identified as observations which seem to be inconsistent with the other collected data (Barnett and Lewis, 1994). In order to detect cheating, INVALSI follows a two stage method. First, one detects, through a factorial analysis, classes of students with both very high average score and variability close to zero. Second, one assigns a weight to each class based on the probability of belonging to the set of outliers units which is calculated by a fuzzy clustering algorithm.

In the case of NES data, several aspects have to be considered. Data have a typical hierarchical structure (students, classes, schools, regions) and a complex pattern of variability. In the considered case students are those ones nested within classes, schools, and so on. The first element that is quite visible in NES data, particularly for the State examination at the end of low secondary school, is a strong presence of outliers at the second level of the data hierarchy, that is at school level. As suggested by the specific literature, INVALSI applies a procedure based on detection of outliers units at class level combined with a factor analysis with a fuzzy clustering approach. With this method is possible to go over the logic of hard clustering that with a dichotomous approach classifies each unit as outlier or not outlier. The fuzzy logic approach seems to be very fruitful because it allows to compute a measure for each unit that conveys the level of similarity to a theoretical profile of an outlier unit, that is a potential cheater (INVALSI, 2010).

The above shortly described method is very useful in order to give back to the community really informative data. Furthermore, the publication of the results of data cleaning had another positive consequence. Because the cheating phenomena are strongly circumscribed by a geography point of view, a large debate has begun about the problem. Especially for the State examination at the end of low secondary school, the measures adopted in some regions have strongly reduced the cheating evidences.

From a more methodological point of view the data cleaning techniques applied by INVALSI seem to be useful. Indeed, the effects of the application of the above described methods have been recently verified by comparing the results of NES in the so called sample classes with other classes. In the first type of classes the test administration is monitored by an external personal that has to ensure both the correctness of all the procedures, and data imputation.

In the last two school years data of the called sample classes have not been affected by cheating, or the relevance of the phenomenon is relatively small. If we observe the population data, that is data of the other classes where tests are administered by school teachers, we can clearly find a relevant quantity of outliers. But the presence of these outliers is predominately limited to the same regions where in the previous surveys cheating evidences were strongly detected.

If the cheating detection method is applied to population data the results we obtain are very close to those we observe in the sample classes. This latter result is extremity relevant, because on the one hand enforce the necessity to have a sample of observed classes within the population; on the other hand the result seems to corroborate the method robustness.

Furthermore, the cheating detection method is fruitful because it gives an idea of the general results distribution without the effect of incorrect teacher and student behaviour. Besides, with the necessary caution, by using this cleaning procedure, the above briefly described techniques allow the study of the results distribution within the classes, as we observed in absence of cheating data.

Obviously, each violation of correctness in test administration represents a *vulnus* that can be only partially mended by applying *ex post* a method that tries to reduce the effects of these incorrect behaviours. That said, it is necessary to take into account other methodologies for cheating detecting. In this way it is possible to find better measures of incorrect behaviours and compare the results of different methods.

In this perspective INVALSI is studying alternative methods to prevent on the one hand the inclusion of data affected by cheating and on the other hand to avoid *false accusation* (type 1 error). These methods look at the number of matching answers and ignore other suspicious patterns such as grouping or sequences in answer matches. One reason for this is to make some assumptions, in particular about copying behaviour that, as known, can assume many forms. Another reason of this new approach is to keep the method as understandable and as easy as possible. Indeed, the method currently used by INVALSI seems to be quite effective but extremely difficult to communicate outside the community of statisticians. This aspect is surely a strong limitation, because it can favour adverse attitudes towards the application of statistical methods in this field of research.

2.3 Data availability

In the last years the data protection law (d. lgs. 196/2003) has been often misinterpreted with an evident restriction of research opportunities for the scientific community. On the one hand this restrictive interpretation of the law has surely increased the data security, on the other hand this tendency has appreciably limited the research opportunities and the possibility to disseminate the information derived from data gathered over the years.

Starting in 2007, in order to face this kind of situation, INVALSI tries to find a way to ensure the data confidentiality and at the same time to disseminate information about the Italian educational system. In particular, the institute spends several efforts to find a satisfying balance between the limitation imposed by the law and the necessity to realize and promote research about the educational outcomes. As said before, it is particular relevant to keep a balance between these two needs. On this equilibrium lays the possibility to realize a NES able to help schools, to drive their activities also by using comparable data and to give to the stakeholders the opportunity to know more in depth the educational system.

It is clear that the value of the huge amount of data that INVALSI has collected over the years could increase if they were used by the scientific community in order to promote empirical research. Obviously, educational data cannot be released with information regarding the school or even the classes. This caution is important for two reason. First, INVALSI surveys are conducted on schools and students whose privacy has to be protected according to law dispositions. Although data are anonymously collected, it is clear that in some cases the information matching could enable the identification of the school or even the class. Second, data protection is a crucial part of the trust agreement between schools and INVALSI. This agreement permits in the majority of cases to obtain good data from the schools. Good data are crucial because they are the cornerstone of benchmarks (at regional and national level) that allow schools to have at their disposal a powerful tool to compare their results and the effects of their methodological decisions.

As well known, data on achievement are crucial, but they cannot exhaust the very large elements that contribute to educational outcomes. Other data, like background covariates, are crucial in order to understand factors that play an important role. In this perspective, INVALSI is doing a big effort to match several sources of data, so that researchers and stakeholders can try to explain the achievement results by analyzing also other contextual data. In this perspective, INVALSI has began, in the last three years, several collaborations projects with other public and private institutions, in order to enrich the information of its databases.

Obviously, the construction of databases that match several information of different sources calls for attention on its construction and especially on its keeping. When data are given to researchers, some information is deleted in order to make the link to a specific school impossible. For instance, data about students with special needs (month of birth, and so on) are deleted, because these data could potentially be used as *spy variables* that would make possible an identification with a specific school or, even worse, a group of students. In the last two years NES has began a collaboration with the main associations for special need students. In these perspective data are collected according to data protection law with the aim to give these data (number of pupils with special needs, percentage distribution among the kind of disabilities, test results, and so on) to persons that are doing research on this specific topic.

Taking into account the above mentioned conditions, INVALSI has realized a web based system to deliver data and analyses to the scientific community and to the stakeholders. The system permits the unequivocal identification of people and institutions interested in obtaining data from INVALSI. In this way it is possible to satisfy the basic requirements and, at same time, to organize the delivered datasets with a structure that makes easier the fulfilment of the research goals.

3 Data access

INVALSI organizes its data delivery system to enable an easy and effective data access. Data about national surveys, like NES, and international surveys, like OECD-PISA and IEA-TIMSS, are available on the INVALSI web site. INVALSI ensures also the possibility to download data about adult skills, measured by the international survey like OCSE-ALL.

On the INVALSI web site data about all the editions of national and international surveys are freely available. All the data are available at student level (in respect of data protection law) with the possibility to download a large amount of collateral data (covariates). Covariates are particular important for the researcher community because they allow an in depth study of the effect of several variables on student achievement.
Dataset are easy to get. Everyone interested in working with data collected by INVALSI needs to fill in some forms, as requested by the law.

In some case, INVALSI can match more databases from different sources in order to give to the scientific community an information, as reach as possible.

4 Further developments

With the explicit aim to enlarge the knowledge about the most relevant changes of our educational system, INVALSI is working in order to give a diachronic perspective to its data and its analyses.

Indeed, the longitudinal perspective is crucial in order to understand the main factors that exert any influence on educational outcomes. This perspective is strategic for schools to know the effects of their choices and strategies, for researchers to understand the consequences of political and systemic decisions, and last, but not least, for the large number of stakeholders interested in the evolution of the educational system within the larger context of social changes.

Another important aspect is the possibility to give to the schools and to the system information in terms of value added. More simply, for value added of the school is meant the measure of the skill level variation of students as consequence of teaching. At the moment, NES is able to give a value added information just in terms of relative placement (ranking) of the school based on some information (social background, some previous school marks in the tested subjects, origin, and so on) about the characteristics of enrolled students (Martini and Ricci, 2010). In the near future, by anchoring the scales, it will possible to calculate a more precise value added. Indeed, anchored scales allow to develop a reasoning in terms of class or student growth curves.

Ensure a robust base for longitudinal analyses requires at first scale anchoring among different tests. The anchoring is a relevant technical challenge that requires several technical issues to be considered. Scale anchoring in national surveys on educational outcomes is completely new in the Italian context, but nevertheless extremely important. The tests administered by INVALSI are designed to estimate a large scale of each considered skill, so that the items are well spread along the continuum and, for this reason, the test anchoring is relatively easier than the anchoring items with approximately the same level of difficulty.

Psychometrics shows different methods to face the problem of scale anchoring. In the last two years INVALSI has conducted a research project with the aim to anchor the results in different years of tests (Reading comprehension and Mathematics) administered to students at the end of low secondary school (grade 8). Starting from this school year, the project has been enlarged to grades 5 and 6. Through this anchoring it will be possible to compare the results from different surveys in order to find trends and possible diachronic tendencies. Another aspect is strictly connected with the anchoring project, that is the possibility to deepen the substantive interpretation of items within the general scale that they define. As shown by the international surveys on educational outcomes (for instance OECD-PISA, IEA-TIMSS, and so on), the scales are understandable as a proficiency scale in which it is possible to identify different level of proficiency. More explicitly, within the same scale, it is possible to understand what a student with a certain score is able to do and which tasks he/she is strongly likely to overtake. To realize such a scale it is necessary to have at disposal a quite large number of items. Unfortunately this number is certainly greater than the normal number a student can reasonably answer in a *linear* test[2]. At the moment, in NES, it is not possible to apply a rotate administration design, because it

[2] For the test theory a test is defined as linear when all respondents have to answer to the same items, i.e. no rotation design is applied to the test administration.

would require a relevant part of items to remain secret. However, this drawback can be overtaken by scale anchoring. In this way INVALSI is building a unique scale on which the difficulty and the discrimination power of more than 100 items[3] is measured. Therefore, it is possible to identify difficulty levels and after that to interpret from a substantive point of view the meaning of each scale level.

It is self-evident how important this approach is. It allows schools, stakeholders, and researchers to find tendencies, strengths, and weaknesses of the educational system. An example could be useful to appreciate how much this approach is relevant. If we take into account the reading comprehension scale it is important to know in a certain aggregate the number of low and high performance students. If one has at disposal anchored scale it is possible to analyse the changes of these number over the time. Following the example, because the scale remains the same, it is possible to understand if number of poor and smart students is changed and if their distance has reduced or not.

The scale anchoring is obviously only one aspect that gives a diachronic perspective to INVALSI data. Indeed, through the anchoring it is possible to analyze trends among years, but not for the same group of students. In order to face this latter aspect, INVALSI has began, in collaboration with the Ministry of Education, a new way to collect data. In the next years, it will be possible to introduce a longitudinal dimension in the data collected by INVALSI, whose analyses will be accessible to researchers, schools, stakeholders, and so on. Starting from the current school year (2010-11) INVALSI collects data from schools by including the ministerial code that identifies univocally a student from the beginning to the end of his/her educational path. This approach permits to respect the data protection law and at same time to follow the student test results in different years.

The possible perspectives of this approach are self-evident and they really can help a better understanding of how students are growing up within the school system. Furthermore, the implementation of this new way to collect data can help in the following years to reduce the impact of data demand to schools, with a clear increase of data quality and school collaboration.

5 Final discussion

As briefly discussed in the previous paragraphs, the availability of data about school system and students achievement is extremely important to promote empirical based knowledge of a strategic immaterial infrastructure like Education.

However, the organisation and implementation of micro data archives is a challenge that involves several aspects, not only of technical nature.

At international level it is quite clear that autonomy of schools requires evaluation of the results that are realized within the school system. Without a measurement system there is no possibility to understand if Education is guaranteed to all pupils and the quality level of the human capital of a country. Without measurement the first aspect that is threaten is the equity of school system with obvious consequences.

[3] In this case the terms difficulty and discrimination power are used in the sense of Item Response Theory (see, for instance, Van der Linden, W. J. and Hambleton, R. K. (1997). *Handbook of Modern Item Response Theory*. NY: Springer-Verlag)

Especially in Italy, the possibility to put to the test theories, structural changes, or experimental projects is crucial to promote a real improvement of educational system. In this sense, data are essential. The challenge that INVALSI is trying to face is to implement archives that are able at the same time to give an effective answer to different questions. First, the necessity of the scientific community to get an easy access to data, possibly matched from different sources. Second, the full respect of data protection law, but not in a manner that transform the low requirements in a sort of loop note that *de facto* inhibits research and knowledge. Third, the necessity of schools to have their own data protected and, not less important, organized in a way accessible to people without specific analytical skills.

In this general context the availability of micro data archives in educational measurement is like the last mile for electrical or phone lines. Even if the main line is an excellent infrastructure, but the last mile is not working, it is not possible to have light or phone line at home. In the same way the realisation of effective micro data archives is a basilar condition to download, interpret, and use them in order to produce knowledge and interpretation about phenomena for its nature complex, polyhedric, and nested within other social issues.

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Spatial Analysis in agricultural census data management: the distance counts

Davide Fardelli e Domenico de Vincenzo[1]

Abstract This work focus the relevance of Geographical Information System (GIS) as research tool in supporting decisions. We try to answer to question, if GIS is an old tool or if it represents a new way to read and interpret geographical and statistical data. Numeric cartography is beyond the spatial data displaying, in fact it is useful also for the interpretation of data. This peculiarity was present in "manual" thematic cartography too, but it became prevalent in GIS. Indeed, GIS is a fastest, integrated and composite data analysis tool. The paper will present a methodology to analyze the production specialization in agriculture. This methodology belongs to the "point pattern analysis" and precisely, called distance function, it combines both distance and density. We are going to apply this method to the agriculture sector, so it is an useful instrument in the spatial analysis: it can equalize more municipalities having different size and it can functional areas to the local scale where there are prevalent crops. Every prevalent crops can be associate to production specialization in the reference area. This study will be applied to the Lazio with data of Census of Agriculture relating to the utilization of soil. In this way, we use a statistical methodology, applied to the GIS instrument, in order to identify probable choices to adopt.

1 The distance counts

A bibliography about the distance counts is not very wide. It is presented in an original way, but in part partial yet, by David Unwin (1986), in the chapter on the maps for points and about their use through the descriptive indicators of spatial point pattern. In particular, the distance counts, within these kind of indicators, is among the measures based on distance and density. The instrument has been refined and used

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several times in more analysis, above all relating to urban gravitation and metropolitan tertiary, by Gerardo Massimi (1982, 1999). The distance points transforms from point data to areal data, giving back a measure of density, according to a methodology which would exclude pre-instituted boundaries, but it uses the areas formed by circles of radius equal to a significant extent in a local context in consideration. This particular density can be fully assimilated with a gravitational analysis type, if centroids represent a numerical value on a discrete phenomenon (as in classical cases of gravitational analysis, the point is a measure of the "mass" of centroid, for more detailed examination see Reilly). Instead, the length of the radius of circle expresses a purposeful distance relating to the flows bounded with the phenomenon of centroid. In this way we can have two types of analysis: first, a type self-referenced, when the analysis reproduces the mutual gravitation of homogeneous elements "one-to-one" relationship (a point representing himself) or "one-to-many" relationship (a point represents a set of elements) (Fig. 1), or a second type "eteroreferenziato" (externally referenced), when the method proposed for analysis of gravity of a distribution of points (residents, clients, etc..), is compared to some specific locations (urban centers, clients, etc..): in this case, the point features can be either "one to one" as "one to many" (Fig. 2). The distance counts, in fact, can be performed positioning radius anywhere inside the map. The maps used for distance counts are point maps with NOMINAL value (according with Unwin, in nominal maps the points have an individual value, that's to say are "one to one" points) points maps and they are not a generic point density map. That means, each point represents a position as precise as possible of phenomenon (the greater or lesser precision obviously depends on the scale of representation).

Figure 1

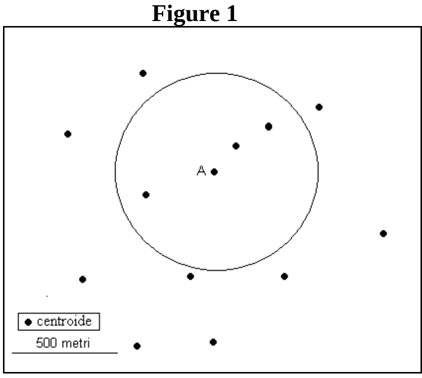
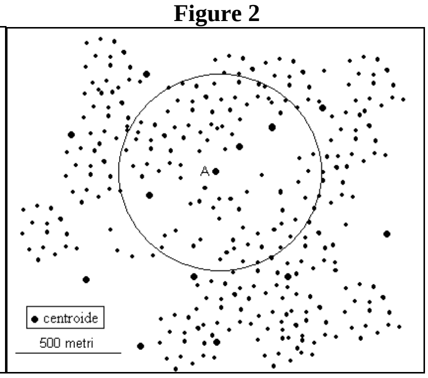


Figure 2



The technique consists of adding all the values contained in the circumference from each centroid of map and assigning the value to the centroid. The second step we need to iterate the distance counts for all the centroids, every centroid will have a new value. The choice of radius obviously affects the final result and, at first sight, may seem arbitrary; but, in a practical problem, it could be chosen to reflect some meaningful threshold.

The transformation from point map to areal data allows us to obtain a "continuous surface". In this way, all centroids are similar to spot-heights, so the data can then be represented by the interpolation of contour lines, similar to those used to draw the relief in maps.

2 The distance counts in the analysis of production specialization in agriculture: the case of Lazio

We are going to apply the method of distance counts to the agriculture sector, so it could be an useful instrument in the spatial analysis: it can equalize more municipalities having different size and it can functional areas to the local scale where there are prevalent crops. Every prevalent crops can be associate to production specialization in the reference area. Indeed, to obtain a fair comparison of agricultural surface for crop we should compare municipal areas having the same extent, which is impossible for the Italian cities. This obstacle can be overcome through a new and specific application of distance counts, used to create an "artificial" municipal area extent. This is done by calculating distance counts, using circles whose area is equal to the surface of the largest administrative area considered. In this case, each centroid represents himself and the centroids entering inside the circle created by the radius. So, the sum of the areas is equal to the largest city's area.

So, if the largest city has an area S_{max}, the radius of the circle is equal to

$$\sqrt{\frac{S_{\max}}{\pi}}\ .$$

Therefore, the value of centroid, corresponding to the area of the circle, is equal to the sum of values expressed from the area of each city entering inside the centroid. In this way, repeating the calculation, pointing the radius on each city, all the city areal will have a similar extent.

This study will be applied to the Lazio with data of Census of Agriculture 2000 relating to the land use.

In this way, we use a statistical methodology, applied to the GIS instrument, in order to identify some probable choices to adopt.

We have used the software Arc-Map version 9.3, in which does not exist a specific tool to get an output for *distance counts*, so we have had approximations and subsequent adjustments. The results are quite satisfactory, however, also the GIS software has been satisfactory because it was in gradually adapt to the needs requested. The choice of radius was 11.8 Km, equivalent to the area of the city of Viterbo (406 Km^2), the largest extension in Lazio after Rome that, because of its size, would have to obtain ranges of anomalous dimensions. We show here - for example - a map on the crop of cereals, obtained by this automated procedure (Fig. 3), where there are 'strong' areas: we can see the area of Rome and the province of Viterbo. While we can find slightly representative area the valley of the province of Frosinone and the Pontine area (Latina) and Rieti.

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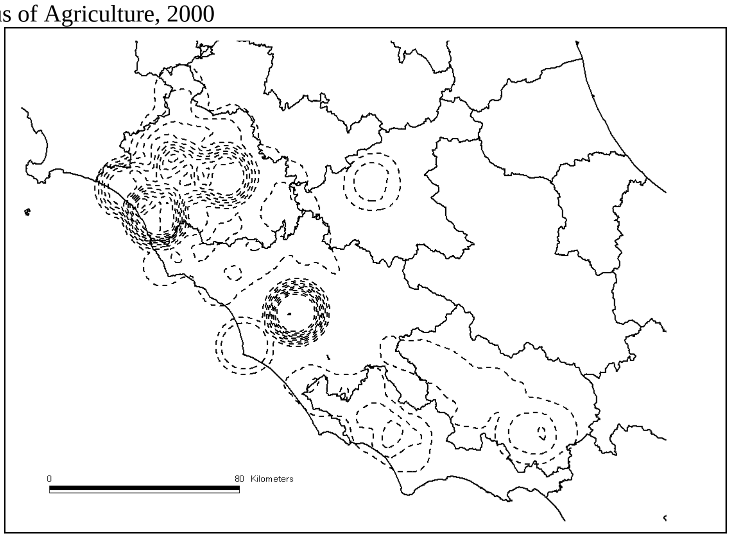
Figure 3 – Distance counts for cereal crop in Lazio (radius = 11,8 km), Census of Agriculture, 2000



Source: Based on ISTAT data.

Changes in the geographical distribution of inhabitants in the Municipalities of Tuscany since 1861: some empirical evidences

Luca Faustini, Graziella Sanna, Cristiano Tessitore, Alessandro Valentini[1]

Abstract Since the unification of Italy until recent years Tuscany accounted a huge change in the amount and in local distribution of population. The aim of this paper is to quantify the extent of modifications considering both the geographical and administrative perspective. This allows to compare how the residential profile of the region changed over years.

1 Methodology

In 1861 around 1.9 Millions of inhabitants lived in Tuscany. Today this number has nearly doubled (3.6 Millions). However, variations were not homogenous in the whole region: for instance, during the last 150 years the population of Florence (regional capital, and capital of Italy since 1865 to 1871) grew about 400%. Vice-versa the number of residents in the historical town of San Miniato has remained nearly unchanged.

To verify whether deviations in local trend will be attributable to characteristics of the profile (altimetry, proximity to the coast and so on) rather than legislative rules (for example administrative boundaries of provinces) the analysis are performed following three steps: (i) removing perturbations due to transformations in the administrative boundaries (via statistical procedures); (ii) classifying Municipalities according some significant criteria iii) linking each group of communes to their population changes. Census data about legal population (1861 – 2001) are used.

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2 Estimate of the population on the borders of the time

In 1861 the geographical territory of Tuscany was administratively divided into 269 municipalities [1], [2]. Despite confines of the region haven't been varied over time[1], some legislative actions have changed the boundaries of half of the communes (affecting around 63% of the total population), and in most cases borders of Provinces (Prato, for instance, was separated by Firenze less than 20 years ago). A certain number of towns (40) was created by incorporating territory of dissolved commons (22); other municipalities increased or decreased their territories and hence their population. As a consequence, to investigate changes in the level of population between 1861 al 2001 at sub-regional level, it is first necessary to use a statistical procedure to estimate what would have been the total population of each municipality at preceding censuses with actual border line.

Assume $P(i,t)$ will be the population (at the borders of the time) of municipality i at census t; $P^{\wedge}(i,t)$ will instead be the estimate (at time t) of the total population of such municipality if the town had had actual boundaries. If during the period 1861 – 2001 no changes in the borders occurred, hence $P^{\wedge}(i,t) = P(i,t)\ \forall t$;

If at time t^* a legislative change in the borders implies a shift of X persons from i to j $X(i,j,t^*)$ the (historical) estimate of both populations at actual boundaries is the following:

Municipality i (posting of boundaries):

$$P^{\wedge}(i,t) = \begin{cases} P(i,t) & t \geq t^* \\ P(i,t)\cdot[1-X(i,j,t^*)]/P(i,t^*) & t<t^* \end{cases}$$

Municipality j (annexations):

$$P^{\wedge}(j,t) = \begin{cases} P(j,t) & t \geq t^* \\ P(j,t)+P(i,t)\cdot X(i,j,t^*)/P(i,t^*) & t<t^* \end{cases}$$

More complex cases (multiple annexations in subsequent years, annexations and detachments and so on) are treated in similar ways.

3 Classification of municipality for the analysis

Municipalities are classified according various features. From an administrative point of view, Provinces and "crown" (where towns are grouped in provincial capital, neighbors of provincial capitals, and others) are used. Concerning geographical profile, altitude (inland mountain [IM], coastal mountain [CM], inland hills [IH], coastal hills [CH], plains [P]) and proximity to the coast (coastal, non coastal) are included. The average annual rate of change between 1861 and 2001 (equal to 4.3‰ for the whole region) for each group is illustrated in Table 1.

The most dynamic area is represented by the province of Prato (+10.2‰), with an incidence of population over the whole region of around 6.5%. In terms of crown, the most dynamics municipalities are represented by Provincial Capital (+5.7‰), followed by the commons neighbours. Stratifying population by geographical characters, growth is more intensive in coastal mountain (+8.2‰) and in general in non coastal areas (+7,1‰).

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1 The only exception is represented by the acquisition of about 200 residents from Fiumalbo (MO) in the 1950'

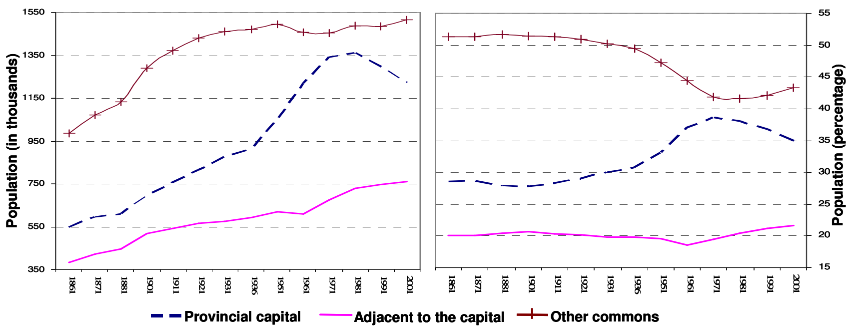
Table 1: Average annual rate of change (per 1,000) between 1861 and 2001 for various groups of municipalities (in parenthesis the percentage weight on the regional population in 2001).

Total Trend	**+ 4.3**	***Crown:***	
Provinces:		Provincial Capital	+ 5.7 (35.0%)
Massa Carrara	+ 4.8 (5.7%)	Adjacent to the Capital	+ 4.8 (21.7%)
Lucca	+ 3.0 (10.6%)	Other common	+ 3.1 (43.3%)
Pistoia	+ 4.5 (7.7%)	***Altitude:***	
Firenze	+ 4.9 (26.7%)	Inland mountain	+ 0.1 (9.6%)
Prato	+ 10.2 (6.5%)	Coastal mountain	+ 8.2 (4.5%)
Livorno	+ 5.3 (9.3%)	Inland hills	+ 4.5 (53.3%)
Pisa	+ 3.4 (11.0%)	Coastal hills	+ 4.9 (12.7%)
Arezzo	+ 2.9 (9.3%)	Plains	+ 5.6 (19.9%)
Siena	+ 1.9 (7.2%)	***Proximity to the coast:***	
Grosseto	+ 5.3 (6.0%)	Coastal	+ 3.6 (76.3)
		Not coastal	+ 7.1 (23.7)

4 Detailed trend of the crowns

Among the criteria for classification, the one based on the crowns is particularly interesting. Figure 1 shows the total trend of population (in absolute and relative values) by crown; both graphs witness a huge population increase in provincial capitals from Word War II to 80's. Vice-versa municipalities adjacent to the capital performed a three-step increase in absolute values (1861-1881; 1891-1961; 1961-2001), and a constant trend in relative values (right graph). Population in other commons remains somewhat unchanged since the years among the wars, even if its quota decreases significantly in the same period (except for a weak gain in the last two censuses).

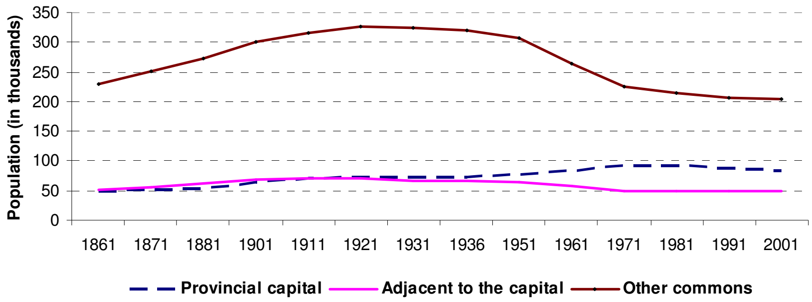
Figure 1: Population trend by crown, Tuscany (left: Absolute values; right: Relative values) – Years 1861-2001



At a deeper level of analysis, a contingency table has been defined cross-tabulating each population census by altimetric and crown profile. From one hand, the analysis shows that the overtime population profile by crowns is qualitatively similar to the whole regional profile in the altimetric areas CM, IH, CH, P. On the other hand, the altimetric area IM, with reference to “other commons”, shows an increasing population trend from 1861 till the inter war period 1921-1931, and subsequently a general decreasing trend (stronger in the period 1951-1981) - also witnessed by the decrease in the population value registered in 2001 and 1861.

Despite this highlighted trend, the behaviour of the IM curve related to this crown is only partially able to affect the shape of the general curve giving the relevance of the population resident in the IH area with respect to the whole regional population (that shows a similar hump in the same period).

Figure 2: Total trend of population by crown for Inland Mountain (IM) municipalities *(figures in thousands)* – Years 1861-2001



5 Conclusions

The study of population trends over years can lead to some interesting results. In particular, classifying data by geographic and administrative variables may show some trends that could be hidden analyzing aggregate data. As showed in §4, drilling down data provides a deeper level of investigation. Indeed, only cross tabulating the number of inhabitants by crown and altimetry helped us to get a more detailed understanding of the overtime trends of distribution. This approach will be the main path of analysis to follow in the next steps related to this work (for instance considering relative distributions or applying more sophisticated methods as logistic regression and so on...). Actually it could be a good starting point for historical and sociological analysis of the Tuscany.

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Donne e vittimizzazione nell'indagine Istat "Sicurezza dei Cittadini": una storia di genere

Alessandra Federici e Daria Squillante

Abstract The last 60 years show and represent an extraordinary path for the "feminine question", since the progressive empowerment - even though largely insufficient - that women reached in the labour market, in the legal system, in social inclusion and politic opportunities. Therefore a question: how these conquests have reinforced the women's perception of safety? How subjective feelings are prevalent than the objective ones? In the safety concept we recognize the *subjective* and *objective* aspect: the fear of crime and the victimization risk; safety perception and the environmental decay; victims' characteristics and the criminality level. Focusing attention just on subjective or objective conceptual categories prevent a more wide "knowledge space" and an approach which consider and interlace many factors, analyzing and understanding connections and correlations. Moreover, a more comprehensive and complex approach also allows to over going a stereotyped approach to gender safety: in the "safety question", in fact, women are always considered as potential victims, since their traditional role of weak, fragile and fearful subjects. But in the Italian actuality and context that passive position and condition is always true? A trend analysis of the three ISTAT waves on Citizens' Safety Survey (1997-'98, 2002 e 2008-'09) combines in a gender (feminine) perspective the subjective (being) and objective (having) aspects of safety: time spent not at home; daily life habits; the relationship with law enforcement; victimization experiences; diseases and blackmails at work: just some example of analysis to question Italian women as far as their (perceived) safety is concerned.

1 Paura del crimine e sicurezza: tra *essere/soggettivo* e *avere/oggettivo*

La paura del crimine come «paura di essere vittima di un crimine rispetto alla reale possibilità di diventarne vittima» nella cultura occidentale spesso si sostanzia nella differenziazione tra pubblico sentimento e percezione individuale del rischio di vittimizzazione. Legato al concetto di paura del crimine è intrecciato il concetto di sicurezza, in cui emergono l'aspetto soggettivo e quello oggettivo, in cui cioè si combinano tra loro la paura di correre dei pericoli al rischio reale di vittimizzazione, le caratteristiche strutturali della vittima al livello di criminalità presente nella zona in cui si vive. Evidente quindi la difficoltà di distinguere, di rilevare e di misurare: la tendenza a *sentire* le situazioni come paurose (*essere/soggettivo*) e *l'esperienza* concreta di paura (*avere/oggettivo*), il senso di ansia indeterminata nei confronti dell'ignoto e il senso di preoccupazione nei confronti di eventi conosciuti, reali, che minacciano l'individuo. Di qui la necessità di un criterio conoscitivo e metodologico che tenga in considerazione i più fattori e i più agenti di natura diversa che compongono la sintassi della sicurezza e che consenta di procedere alla sua analisi attraverso connessioni e congiunzioni lineari. I sentimenti, le percezioni, i

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comportamenti ed i fatti, come facce/aspetti di un prisma/fenomeno, producono infatti una molteplicità di colori/approcci che disegnano/descrivono in modo multiforme/complesso la *Sicurezza*.

Sensazioni di paura e atteggiamenti di insicurezza possono provocare un certo numero di effetti negativi sull'*esistenzialità* individuale e collettiva: possono erodere l'*io* e il *noi* del benessere; possono alterare le attività di routine, le abitudini del singolo; possono contribuire a rendere il luogo in cui si vive un "non-luogo", una costruzione avulsa dal cittadino; possono contribuire alla perdita della coesione, della fiducia e della stabilità sociale. Eppure, un certo grado di risposta emotiva può essere salutare: gli psicologi hanno da tempo messo in evidenza come il senso di preoccupazione può essere un'attività di *problem-solving*, che motiva, cura e favorisce comportamenti e gesti precauzionali e può stimolare il senso di solidarietà sociale. Questo comporta la necessità di distinguere tra ansie di basso livello che motivano e aiutano alla cautela, e preoccupazioni che paralizzano e danneggiano il "ben-stare".

Una percezione "locale" del pericolo di criminalità nella zona in cui si vive e una percezione "diffusa" del rischio di vittimizzazione, in cui si distinguono l'angoscia e l'inquietudine irrazionale ed istintiva di subire un reato, rispecchiano come se non bastasse il ritmo e la direzione del cambiamento sociale. Le influenze culturali sono certamente fattori imprimenti da tenere in considerazione: i tempi moderni – la pervasività e la diffusione del senso di precarietà lavorativo; lo "spauracchio" della diversità nella multi-etnicità/culturalità; lo svilimento della moralità; la mutilazione dell'etica sociale – hanno lasciato le persone particolarmente sensibili ai temi della sicurezza e della insicurezza sociale. Non di meno bisogna tenere in considerazione il fatto che, anche se non tutti possono dirsi vittima di un reato, atti criminali toccano di riflesso l'individuo. La ripetuta esposizione mediatica degli ultimi anni a eventi delittuosi sensazionalistici, può nel complesso diventare una potente forza estraniante che ricade direttamente o indirettamente sul pensiero collettivo di sicurezza.

In tutto questo ci si chiede se la differenza di genere è anche differenza nel/del modo di percepire la paura di subire un reato, di percepire la zona in cui si vive a rischio di criminalità, ci si chiede dunque: la *sicurezza di genere* come un nuovo capitolo della *questione* e *dell'emancipazione femminile?*

2 Viaggio tra i risultati dell'indagine "Sicurezza dei cittadini"

L'indagine sulla "Sicurezza dei cittadini" condotta dall'Istat in tre momenti diversi (1997-98, 2002 e 2008-09) nasce con lo scopo di conoscere il fenomeno della criminalità attraverso il punto di vista della vittima. Essa permette di stimare il "sommerso" di un gran numero di reati, personali e familiari, e di identificare i gruppi di popolazione più a rischio: profilo delle vittime; come, dove e quando hanno subito il reato; relazione con l'autore del reato; stile e abitudini di vita; ambiente familiare e sociale in cui vive; età e genere; status sociale, ed altro. Offre, inoltre, il quadro della percezione della sicurezza (la paura e la preoccupazione di subire i reati e il livello di vittimizzazione), del rischio percepito della criminalità nella zona in cui si vive, del rapporto con le forze dell'ordine e delle strategie messe in atto da individui e famiglie per difendersi.

È in tale contesto che si indaga la posizione della donna come vittima e come cittadina sia in relazione al suo modo di *esprimere* la *fear of crime* che di *vivere* il contesto sociale e ambientale. L'analisi passa necessariamente attraverso il confronto di genere per tutti quegli aspetti, soggettivi e oggettivi, che risultano indispensabili affinché sia possibile descrivere il senso di sicurezza/insicurezza proprio della donna.

2.1 Descrivendo il trend sugli ultimi 12 anni

Nel confronto tra le tre tornate di indagine, che abbracciano gli ultimi dodici anni di storia, prendendo in considerazione il tasso di vittimizzazione emerso sul piano nazionale, si nota una significativa e continua diminuzione di accadimento di molti reati. Mentre il numero delle vittime dei reati contro gli individui (rapine, aggressioni scippi, borseggi, furto di oggetti personali) è complessivamente stabile negli anni, nel 2008-2009 aumenta il numero di uomini che hanno subito un furto (*almeno uno* tra scippi, borseggi, furto di oggetti personali) e di contro diminuisce il numero di donne che hanno subito *almeno un* reato violento - rapina e/o aggressione. Si conferma inoltre la tendenza per cui, in tutti i reati contro gli individui, la maggior parte delle

vittime, donne e uomini, è giovane ed in particolare ha un'età compresa tra i 14 e i 34 anni.
Focalizzando l'attenzione agli ultimi anni considerati dall'indagine, la paura individuale è un fenomeno che coinvolge una elevata percentuale di cittadini (il 28,9 per cento prova "poca o per niente sicurezza quando esce da solo ed è buio", mentre l'11,6 per cento "non esce mai di casa", né da solo né in compagnia), l'insicurezza è più diffusa tra le donne (37,0 per cento contro il 20,1 per cento degli uomini), soprattutto tra le giovanissime (47,0 per cento). Anche il condizionamento della criminalità rispetto ai propri comportamenti tra il 2008 ed il 2009 (ma anche negli altri anni considerati dalle indagini) è percepito come elevato. Ancora una volta le differenze di genere ed età sono piuttosto marcate: dichiarano di essere "molto/abbastanza condizionate dalla paura della criminalità" il 57,8 per cento delle donne contro il 38,4 per cento degli uomini e le percentuali di cittadini timorosi sono più elevate all'aumentare dell'età, fatta eccezione per gli ultrasettantenni; il 41,2 per cento delle donne afferma di non uscire da sola quando è già buio a causa della propria paura, contro l'8,1 per cento degli uomini, il dato è maggiore soprattutto per le donne più anziane, con più di 55 anni. In generale, le donne mostrano un livello di preoccupazione di poter subire dei reati, più alto degli uomini. Differenza evidente soprattutto per quanto riguarda la preoccupazione di subire una violenza sessuale (sono molto preoccupate il 31,8 per cento delle donne contro il 15,9 degli uomini), ma anche nella preoccupazione di subire delle aggressioni e delle rapine (molto preoccupate di subire una aggressione/rapina il 25,4 per cento nelle donne contro il 14,1 per cento negli uomini). La differenza percentuale sembra attenuarsi solo relativamente al timore di subire il furto della propria auto.
A livello nazionale, mentre rimane invariata la percentuale di cittadini/e "poco o per niente sicuri/e" "in strada quando si è da soli/e e fuori è già buio", la quota di popolazione che si sente "molto sicura" diminuisce notevolmente, soprattutto tra il 1997-1998 e il 2002, a favore di coloro "abbastanza sicuri/e" nel 2002 e di chi "non esce mai" nel 2008-2009. Per la sola porzione di cittadine donne, il guadagno in sicurezza, evidente tra 1997-1998 e il 2002, si perde nel 2008-2009 in quanto in crescita il numero di donne insicure (per il 2008-2009 vedi dato riportato più sopra).
L'aumento di preoccupazione per i reati violenti si riscontra invece generalizzato per entrambi i sessi. Le donne più degli uomini pensano che le forze dell'ordine "riescono poco e per niente a controllare la criminalità nella propria zona", che, per tale ragione, dovrebbero "passare più spesso per le strade", "vigilando con più attenzione", e valutano il livello di criminalità maggiore rispetto agli anni precedenti l'intervista. L'andamento di tale risultato è costante in tutte e tre le indagini condotte.
Quale "percezione" del luogo in cui si vive emerge negli ultimi dodici anni? Per tutti gli indicatori di inciviltà (*soft crimes*) – "atti di vandalismo contro il bene pubblico", "vagabondi o persone senza fissa dimora", "persone che si drogano" o "che spacciano droga", "prostitute in cerca di clienti" - il dato nazionale migliora nel confronto tra le indagini del 1997-98 e del 2008-2009, sebbene raffrontando l'indagine 2002 con quella del 2008-2009 il valore percentuale è complessivamente stabile, fatta eccezione per la flessione del dato inerente "vede prostitute nelle strade". Nel corso degli anni gli uomini mostrano di avere più occasione delle donne di notare e di rilevare tutte le tipologie di azioni/situazioni degradanti sopra descritte.

2.2 Esplorando la sicurezza al femminile

Senso comune vorrebbe che la paura della criminalità delle donne fosse strettamente collegata al rischio di vittimizzazione, secondo l'equazione "più senso di paura più reati subiti" e viceversa. Si nota in realtà come le donne abbiano un tasso più alto di paura nonostante abbiano meno probabilità di essere bersaglio della criminalità rispetto ai maschi[2].
In tal senso è lecito domandarsi se le cifre, i numeri, i tassi, in realtà *nascondano* la paura e se l'impatto del crimine sia *funzione* del rischio, della combinazione, della vulnerabilità e della relazione di "*genere"*.

2 Si può applicare in tal senso il concetto di "*negligenza della probabilità*" per cui le donne spesso sono più preoccupate di poter subire eventi delittuosi che hanno scarsa probabilità di accadere (ad es: la violenza sessuale di uno sconosciuto in casa propria) piuttosto che di diventare vittima di reati che statisticamente si verificano con alta frequenza (es: il furto della macchina) confermando in tal senso l'affermazione per cui "la paura percepita spesso non è avvalorata dalle statistiche".

Nascondimento. Spesso le statistiche sull'impatto della criminalità nei confronti delle donne sono orientate soprattutto a rilevare e mettere in evidenza l'accadimento di reati minori – ad esempio contro la proprietà - o sono volte a esaltare l'accadimento di crimini violenti che hanno eco mediatico. Il rischio è una sottostima di una parte importante di reati subiti - ad esempio la violenza psicologica, economica, oltre che fisica e sessuale entro le mura domestiche - e una concentrazione dell'attenzione sull'aspetto irrazionale della relazione donna-criminalità, sull'*espressione* della paura e del senso di insicurezza.
Combinazione. Da un lato, la neutralizzazione della questione sicurezza come pura e semplice "sicurezza di camminare per le strade della propria città" e, dall'altro, la femminilizzazione della "questione sicurezza" crea una combinazione pericolosa per cui il cittadino ma soprattutto la cittadina è visto/a solo come potenziale vittima della "criminalità di strada".
Vulnerabilità. Il ruolo tradizionalmente attribuito alla donna di *ente* debole, fragile e facilmente soggetta al rischio di diventare vittima di un evento delittuoso, comporta spesso la diffusione del messaggio "difendiamo la donna dal pericolo esterno".
Relazione. Tutte le forme di criminalità sono un "rapporto sociale". Raramente il crimine è casuale: implica particolari significati sociali e gerarchie di potere. Il suo impatto dipende anche e soprattutto dalla relazione tra vittima e autore.

3 Il mito dell'uguaglianza di genere delle vittime

I risultati delle tre indagini su "Sicurezza dei cittadini" mostrano come nell'ultimo decennio la percentuale, in diminuzione costante, dei reati subiti dalla donna in Italia, non è accompagnata da un altrettanta diminuzione: del senso di insicurezza e di paura nel vivere le strade, di notte, da sole; del grado di preoccupazione nel poter subire dei reati violenti (stupro, rapina e aggressione); della percezione della criminalità come un pericolo condizionante le abitudini di vita.

La percezione di sicurezza, la *fear of crime*, sembra avere una chiara connotazione di genere. Il pensiero tradizionalmente e comunemente usato nel dibattito sulla "questione sicurezza" è che le donne nell'ambiente esterno, corrono dei rischi, corrono dei pericoli, devono prendere precauzioni, devono stare attente perché sono facili prede di minacce esterne. L'immaginario contemporaneo così costruito e interiorizzato, autocensura le donne dal vivere pienamente e liberamente l'ambiente circostante e frena la disposizione alla *fiducia generalizzata* «cioè una fiducia non rivolta a una singola persona o a un gruppo di persone, ma la sensazione di poter fare delle cose, che è strettamente connessa al correre dei rischi» (Pitch, 2009).

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The description of the physical dimension of the economy in historical perspective - material flows Italy 1951 -2008

Aldo Femia, Renato Marra Campanale and Donatella Vignani[1]

Abstract Only recently official statistics recognised the importance of satellite material flows accounts that provide beyond-GDP - but GDP-coherent - information by looking at the material dimension of human activities. These accounts, whose conceptual roots can be traced far back in the past, record in weight units all the resources extracted, transformed and returned to Nature, thus providing important knowledge on economic development's environmental weight. Istat assiduously promoted their development and achieved important results by exploiting heterogeneous, fragmentary and sometimes low-quality data. We also present one of the *economy-wide material flow-based* holistic indicators for ecological sustainability, which are available for Italy for 1951-2008, having calculated them *ad hoc* for the 1951-1979 subperiod in occasion of Italy's Unity 150th anniversary. The indicator reported shows Italy's *Material Footprint* steady growth until the mid 1970's, its subsequent slowdown until the mid 1990's and its recent stabilisation, as well as the shift of environmental stress abroad. The paper ends with a hint to the possibility of extending further back, up to Italy's unity times, the times series, on the basis also of work carried out at the Bank of Italy.

1 Official statistics and material flows

There are several ways to look at country's economic development. One interesting way takes into account the physical dimension of the socio-economic system, i.e. the flows of materials put in motion by its functioning. Only recently official statistics recognised, the need to make available, in relation to the ecological sustainability of socio-economic process, more complete information on physical flows due to the

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functioning of society and started providing such information. The conceptual bases for its systematization are not new and are common to those of modern economic accounting, since their roots, just like those of the Input-Output system, can be found in the material balances of the early Soviet Union, at whose development also the young Leontiev did work. At that time, this knowledge was instrumental to the growth of production and surely the impact of growth on natural resources was not the main concern. Nowadays that the statistical profession is engaged in developing information beyond GDP systematically, among other developments it looks again at the material dimension of production, but from a very different perspective, as the development of this information contributes to the achievement of environmental objectives that are, if not opposite, to some degree in conflict with that of economic growth (and measuring the degree of conflict is one aim of this development).

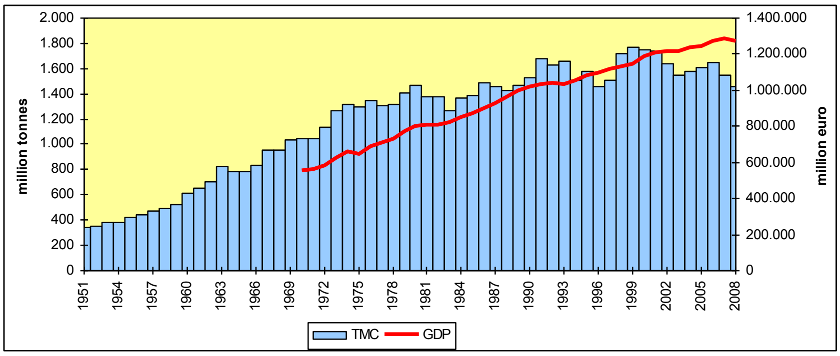
Over the past two decades, a Satellite Physical Accounting System has been developed and raised to the dignity of official statistics. Within this System Material flow accounts (MFA) express in units of weight all material resources extracted from Nature, transformed and returned back to the natural environment in forms, times and places other than those of origin [6, chap. 3]. MFA is the main building blocks of the New Handbook of Integrated Environmental and Economic Accounts SEEA, soon to become an International Statistical Standard. Within MFA, Economy-wide (EW)-MFA [2] is now (with air emission and environmental taxation accounts) one of the three top-priorities in European Official Statistics' Environmental Accounting, which are object of a pending EU regulation. The OECD issued a 3-volumes Manual [4] and two Council Recommendations [5] on the matter. Italy very actively contributed and contributes to these international developments through the Istat, which achieved important results in the field because of an early experience and excellence in the field [3]. In fact, Istat began to develop EW-MFA since the beginning of this decade. EA experts' work consists in the exploitation and reduction to unity and coherence of a large set of heterogeneous, fragmentary and, in some cases, unfortunately, low-quality statistical data. As regards quality, data on extraction from mining and quarrying in the 1980's and 90's represent an emblematic example. Until the seventies of last century there was an excellent administrative source, result of a joint Istat-Ministry of Industry survey. Gradually the survey fell in decay , following the transition of powers in this field to the Regions which, not being adequately equipped, produced increasingly incomplete and discontinuous information. Only since the late 1990's the PRODCOM started providing good quality information, though only at the nation-wide level.

Within the EW-MFA system, it has been defined a family of holistic sustainability indicators, which show the resources removed from the natural environment in order to meet the needs of production and consumption, and the extent to which they: a) are used or remain unused; b) are directly extracted from the national territory or demanded to other parts of the global environment c) are required for domestic or foreign needs.

2 Italy's Material Footprint 1951-2008

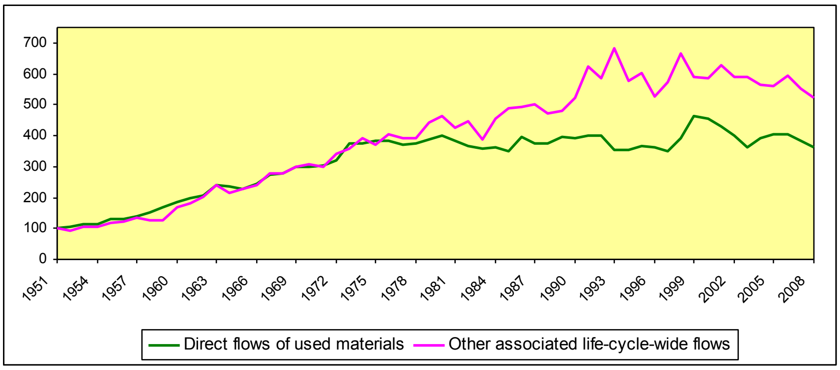
One of the holistic indicators hinted to above, Total Material Consumption (TMC), represents what we may call the *Material Footprint* of a socio-economic system as it accounts for the requirement of material resources of final domestic uses. TMC is a physical measure of potential environmental impact which gauges the overall quantity of natural resources needed by a country to meet the final domestic demand for domestic and foreign products. It is a measure relevant with respect to the environmental pressure exerted at a global level, which accounts for materials that are used or moved but not used, at home or abroad, to realize domestic consumption and investment activities. It is conceptually similar to the very popular – but methodologically doubtful – *ecological footprint*. Istat has calculated this indicator for Italy from 1951 to 2008, reconstructing *ad hoc* for Italy's Unity 150th anniversary the 1951-1979 period (Figure 1). It can be seen as the growth of the Italian economy has been accompanied by a steady growth of physical flows until the early 1970, followed by a slowdown until the 1990's, and by a possible stabilisation in the last two decades. This kind of evolution, viewed in connection with that of the level of economic activity, points out a *relative decoupling* of Italian economic growth from the material input, as GDP has grown much more rapidly than TMC in the period for which GDP data are available in a chained prices time series.

Figure 1: *Total Material Consumption, GDP, Years 1951-2008 (million tonnes, million euro at chained prices, reference year 2000)*



To get some of the dynamics underlying this evolution, TMC can be split in two groups of components (Figure 2): *Direct Flows of Used Materials*, flows actually used in the economy (Domestic Extraction and net Imports) and *Other Associated Life-Cycle-Wide Flows*, flows associated to the actually used materials (Unused Domestic Extraction and net Indirect Flows associated to international trade of products i.e. material resources necessary for the production of net imports). As for the first group's trend, from the mid 1970's the Italian economy has almost proceeded to a *de-materialization* in physical terms, i.e. despite economic growth it has not *directly* used rising quantities of materials. However, the second group of flows continued growing until the early 1990's, determining the further rise of the TMC. The figures also indicate that this was due, in turn, to the net Indirect Flows, which represented by far the largest quantity of materials that are not directly used though moved in order to satisfy the Italian final demand. As in the same period also for the directly used materials the item with the highest growth has been that representing international trade (net physical imports), it may be concluded that foreign natural resource inputs have increased to satisfy Italian domestic demand, replacing the domestic sources. Only from the mid-1990's both components seem to be decoupled from growth.

Figure 2: *Total Material Consumption components, Years 1951-2008, index 1951=100*



3 Further extension possibilities

Sustainability is a very long-term business that needs very long data rows, as only in the historical perspective it is possible to get an idea of how much humanity's power to manipulate the natural environment has increased through time. A recent encounter with a remarkable piece of historical national accounting work carried out at the Bank of Italy [1] - which in order to calculate production values using the "price times quantity" method, reconstructed some important pieces of the information needed for our indicators' calculations - allows us to think that an extension of the time series further back, up to Italy's unity times, is not impossible, at least for some of the indicators of the EW-MFA system (namely, those concerning domestic extraction).

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Organizing the population census, telling the history of unified Italy.

Concetta Ferruzzi, Maria Grazia Bella, Irena Smilkova'

Abstract

This paper aims to emphasize in which way organizational modalities of population censuses reflect the changes in Italian society showing from this point of view a different manner to describe the development of Italy, from the unification to the present day. The aspects analysed in this perspective are: regulation and organizational model; total amount of resources in absolute value and per capita; extension of informational contents of the census questionnaire. From the combined analysis of these data and the parameters for the calculation of Human Development Index (HDI) it can be supposed a theoretical relation among socio-economic and institutional development, growth of population, changes in organizational structure of population census (in terms of subjects concerned and correlative levels of coordination at national, regional, provincial and municipal levels), extension of data to analyze and costs spent for.

1. Introduction

During 150 years from the unification of Italy, our country has been involved in deep economic, social and institutional innovations. These changes have allowed to reach, in 2010, the 23th place (up of 169 countries) in the world list of Human Development Index (HDI) with a level of 0,854, which means a high level of development [7]. The three indexes that compose the HDI, have changed between 1861 and 2001 as follows: per capita Gross National Income - GNI (as a standard of living indicator): from 348

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This research work is carried out by all three authors, however the paragraphs n. 1 and 5 can be attributed to C. Ferruzzi, n. 2 and 3 to I. Smilkova'; n. 4 to M. G. Bella.

lire (1.312 Euro at 2001 value) to 15.020 Euro [5]; education and knowledge, measured by the adult illiteracy rate, decreased from 78% [6] to 1,37% [2]; data on life expectancy: from 30,5 years [9] to 76,7 years for men and 82,9 for women [3]. This paper aims to emphasize in which way different aspects of population censuses reflect these changes showing a different modality to describe the development of Italy, from the unification to the present day. The aspects analysed in this perspective are the following: census regulation and organizational model; total amount of financial resources for census in absolute value and per capita; extension of informational contents of the census.

2. Organizational model

For each round of census, a state law provides for call to the general census and for the related funding. The law is followed by an implementing regulation that sets out the dates of collection, identifies informative contents and outlines the responsibilities of the various bodies involved in the survey. An examination of these provisions point out that the organizational and procedural arrangement of census has gone increasingly to articulate. In the first rounds the census was based on the system of temporary committees at the local level bring to life from the local government bodies in the occasion of census without specific professional qualifications or training of their members. The law of 1881 included for the first time a section on "Management and monitoring of the census" but only since 1901 it began to specify the professional qualifications and education of people involved in the census bodies and to assign the specific tasks to them. In 1901 there is also a need to lighten the work to be implemented by municipalities and to strengthen the commitment of headquarters. For the census of 1911 the Central Bureau of Statistics was reorganized and equipped with more staff. The major organizational changes occured in 1931, after the foundation of the Central Institute of Statistics (CIS). Since then offices and public bodies, subjected to the control and the supervision of the State, were obliged to cooperate with the census operations. In the same year supervision bodies and inspectors, both with the task of propaganda and guarantee of regularity of census operations including the correction of the summary schedules sent by lower-level bodies, were added to the previously established census bodies. The turning point at the organizational level occured in 1936 with the abolition of the temporary local committees and their replacement with the census offices with qualified personnel, in order to relieve the overload of work of the central body. Since 1971 local census operations were supported by regional offices of the CIS with the collaboration of central government and local authorities, regional governments, provincial and municipal authorities and any public and private entities, subjected to the protection, supervision or control by the State. The local census offices are considered as peripherical organs of the Institute. A further change in the organization took place after the adoption in 1989 of the Legislative Decree 322, establishing the Italian National Statistical Institute (ISTAT)

[2] The data are not directly comparable because, in the meantime, the notion of literacy has been changed. For example according the new UNESCO definition of literacy [1958], an international search carried out in 2001, estimated that only the 20% of the Italian adult population has the minimum tools necessary to navigate in the contemporary society [1].

and the National Statistical System (SISTAN) creating in this way a cooperation pattern with specific responsabilities ratified on legislative basis. Moreover in the last two census rounds there were paid more attention to the selection and training of the enumerators, assisted since 1991 by the figure of coordinator.

3. Costs and financing

The increased demand for timely and more elaborate data combined with the grow in population number has tremendously increased census costs. The adoption of new technologies in mapping, data processing and dissemination, while improving the efficiency and quality of the products, has further led to increases in census costs [8]. In fact, from 1861 to 2001 the costs allocated by the Government for census operations are gradually increasing. In terms of per capita spending at actual values, there was a first substantial increase in costs at the 1951 census, taking into account that the cost of 0.91 Euro is to be compared with the one of 1921, equal to 0.17 Euro, as for 1931 and 1936 censuses, neither the budget documents nor the legislative appropriations were found. Low costs of the first census rounds may find their partial explanation in the fact that the very same municipalities had to perform certain tasks at their own expense, such as the transcription of the contents of the family card in 1881, while the law of 1951 census states explicitly that the State will be responsible for the entire expenditure. Afterwards, the increase in costs has been growing exponentially, particularly in 1971 (3.89 Euro) compared with the immediately previous census. To meet the ever increasing costs and appropriations staggered by the Government, the Institute of Statistics, in almost all occasions, had to resort to bank loans. In 1991 with "*significant technical advances in carrying out surveys with the use of remote survey"* [2] and, as evidenced in the previous paragraph, the massive use of enumerators carefully selected and trained, assisted by coordinators as well selected with a great care, justify a considerable increase of allocated costs, amounted to 5.72 Euro. In 2001 census per capita cost increase to 6 Euro.

4. Information and content

In the observed period structural changes of the population were registered into the census patterns. The variables observed increased from 13 to 42. The information content was almost stable until 1971 when it doubled compared to the previous census. The next significant expansion occured in 2001. Main changes were: a) the collection unit, always represented by household and institutional household, but with an edited meaning during the years. From 1861 to 1931 there is not a substantial difference between the two concepts, in fact, they are considered equivalent. Since 1936 they became separate units and were recognized by different forms. In 1951 the two concepts were defined precisely, those definition are still valid, and were formalized by the reform of family law in 1975; b) the concept of population changes, becoming "resident population" since the early 30', the meaning of it was later reinforced by reformed registries law (n. 1228/1954); c) the institution, since 1951, of the housing census; d) the increase in the number of questions about personal data (sex, age, marital status, place of birth, etc.) and socio-economic data (education, profession, etc.) [3]. It should be noted: 1. education: from 1861 to 1931 the only question was whether people could read and write. In 1951, for the first time, was required if people had a degree and this question is broadening more and more until 2001; 2. employment: in 1931 the question concerning the employment began to wide to include new specifications: employment, profession, art, craft and status. In 1961, a whole section was reserved for analysis of occupational and non occupational condition. In 1971 was added a question about the current employment status compared with the status of 1966. From 1971 until 2001, to the traditional demographic and socio-professional characters of the people there were added more questions aimed to analyze the movements of working population and students and the means of transport used.

5. Conclusions

The aspects analysed in this paper are the following: the total amount of resources in absolute value and per capita: from 0.06 Euro of 1861 to 6 Euro of 2001 census (the growth of 216%) against the increase of resident population from 26.328 millions registered in 1861 to 56.996 millions of 2001 [4]; regulation and organizational model: while the law of 1861 did not contain specific organizational rules for census this kind of rules become a substantial part of census regulation in the following period; extension of informational contents of the census questionnaire passing from 13 variables observed in 1861 to 42 of the 2001. During the observed period we had an improvement of socio-economic indexes, an structural institutional development and a population growth. In the meantime, the organizational structure of population census (in terms of subjects concerned and correlative levels of coordination at national, regional, provincial and municipal levels), the extension of data to analyze and relative costs, have changed. So we can imagine a theoretical relation between these parameters and say: organizing the population census means telling the history of Italy.

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[3] Census before World War II required questions relating to religion, property owned, any illness too.

A multidimensional analysis to compare the Agea source and the 6th Agricultural census data: A case study

Romina Filippini, Rosa Maria Lipsi, Giuseppina Ruocco, Michele Antonio Salvatore, Valeria Tomeo, Simona Toti[1]

Abstract: The 6th Agricultural census is based on a census list, derived from the integration of different administrative sources gathering information on the agricultural holdings.
The editing and imputation processes will be supported by the available information from administrative sources in order to improve quality of final results. Particularly, for some specific variables (UUA: Utilised Agricultural Area; TA: Total Area of the holding; Vineyard and Olive plantation areas), the comparison between census data and the administrative register managed by Agea (Italian Paying Agency for Agriculture) is very important to evaluate census accuracy and consistency.
The paper will describe the preliminary results of the comparison between the census and the above mentioned source. Specifically, the main purpose is to investigate potential differences among the information derived from the two sources by applying a multidimensional statistical analysis.

1 Introduction

For the ongoing 6th Agricultural census the editing and imputation processes will be supported by the available information from administrative sources in order to improve final data accuracy. It is important to underline that this census is based on a census list, derived from the integration of different administrative sources ([1], [2]) gathering information on the agricultural holdings.

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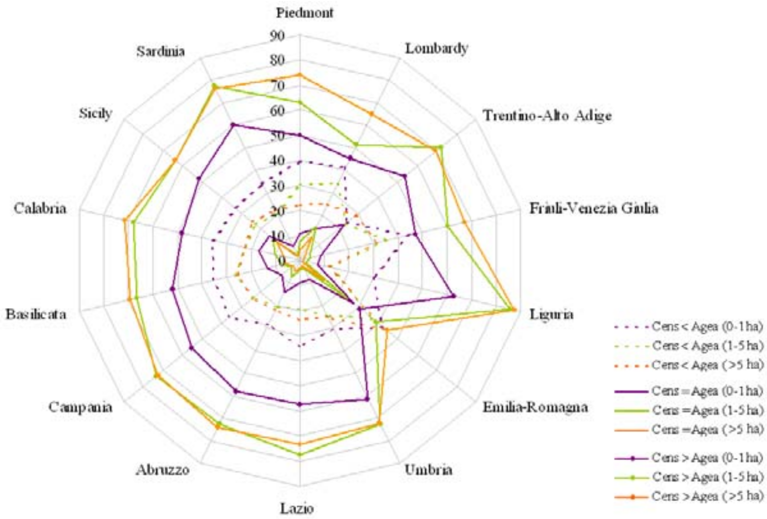
The paper describes the preliminary results of the comparison between the census and the data (about 2 millions holdings) from the administrative register managed by Agea (Italian Paying Agency for Agriculture).
The analysis focuses on provisional data derived from the census. Specifically, we select 866,637 active holdings, excluding those with a null Total Area (TA) either in Agea or census. For these holdings we investigate the differences, at regional and provincial level, between the declared TA in the two databases.
Our aim is to understand whether the differences between census and administrative values are systematic, or due to specific characteristics of particular subsets of units.
The variables considered in the analysis are the size of the holding, the legal form, the type of land ownership, the cultivation of vineyard and the presence of breeding stocks.

2 Main characteristics of the holdings

The holdings considered in this analysis are mainly of small dimension, reflecting the typical structure of Italian agricultural sector. Most of them are individual holdings (96 per cent) usually managed by land-owners (95 per cent) with a total area less than 5 hectares on average (66 per cent).
We have classified the holdings in three size groups: small (0-1 ha), medium (1-5 ha) and large (> 5 ha). In some northern regions (Piedmont, Lombardy, Emilia Romagna) and in Sardinia, the distribution of total area in terms of farm size is similar in administrative and census data, due to the balance between positive and negative differences in the values. In the South, the analysis of the two distributions enhances the prevalence of medium and large holdings declaring higher TA in the census.
As described in figure 1, at national level and considering all the size groups, the census TA is higher than the value declared to Agea. Particularly, the radar chart reports for each region and for each farm size class, the percentage of the holdings according to the sign of the difference (positive, negative and null) between census and Agea. The percentage of holdings having similar values in census and Agea is lower than 10 per cent in most regions and size groups.

The Anova analysis, applied after logarithmic transformation of data, has underlined the contribution of the chosen variables in explaining census and administrative data differences: the legal status, the management system, the vineyard cultivation and animal breeding add more information to describe different behaviours of holdings in releasing data.

Figure 1: Holdings declaring a total area at 6th Agricultural Census equal, higher and lower than that one in Agea by regions (percentage values)

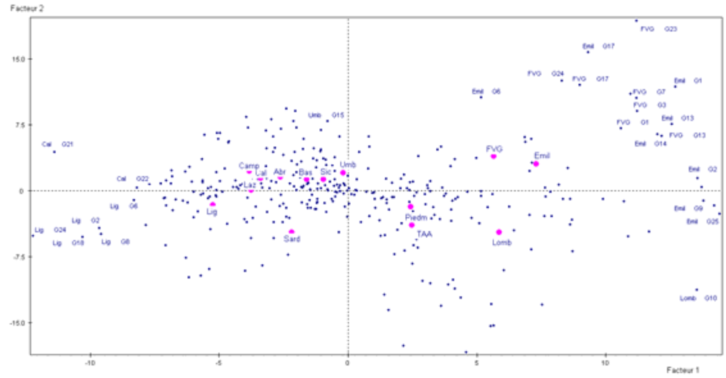


3 MFA on the declared total areas at census and in Agea

Different statistical approaches have been used to carry out the analysis on the declared Total areas in the last agricultural census and in the Agea register.
Starting from the first results of the descriptive analysis, we would like to deepen our investigation. In particular, as further development, we intend to provide a general and synthetic data overview, by a multiple factorial analysis (MFA is the English acronym of Analyse Factorielle Multiple). This technique allows the simultaneous handling of space, intensity and occurrence which are organized into data matrices in three dimensions: “units” (the 20 regions), “variables” (the differences of the total areas for the two databases by legal form of the holding, by the type of land ownership, by the cultivation of Vineyard and by the breeding stock) and “occurrences” (size of holdings: small (0-1 ha), medium (1-5 ha) and large (> 5 ha)).
This method has the advantage to provide a graphic representation which can be easily interpreted in terms of the similarities between regions, regarding the intensity of the differences between the two sources and its profile by the main holdings characteristics.
The first axis of the global analysis accounts for 41 per cent of the variance and the second axis about 20 per cent. The first axis is correlated to the size of the holding, the legal form and the type of land ownership. In fact, if we observe the first factorial plane where each individual is represented, over the length of its path, as many times as there are groups of available observation, we note the regions with higher sizes of holdings on the right of this plane and those with lower sizes on the left of the same plane (figure 2). Individuals (i.e. regions) that contribute much more than others to the

explanation of the first axis are Emilia Romagna which accounts for 24 per cent of the variability of the first axis, Liguria and Calabria (which accounts respectively for about 13 and 5 per cent of the variability), while Basilicata and Abruzzo accounts individually for 2 per cent of the mentioned variability. The second factor opposes the number of cultivation and the presence of breeding stocks. If we look at the projection of regions on the second factorial plane of the global analysis (figure 2), regions that contribute much more than others to the explanation of the second axis are Lombardy which accounts for 21 per cent of the variability of the second axis, Friuli Venezia Giulia for another 14 per cent, and Umbria with another 4 per cent of the variability.

Figure 2: First factorial plan for differences of TA declared by the holdings at Census and in Agea by regions



4 Concluding remarks

This preliminary results points out a different behaviour in the declaration of TA at census and in Agea, mostly due to the various holding characteristics: geographical localization (Northern vs Southern areas), size (small vs large holdings), type of cultivated crops, presence of breeding stocks. Of course, further analysis would be improved to better investigate potential differences among the information derived from the two sources by studying other important variables as the Utilised Agricultural Area (UAA) or the Olive plantation areas or some specific crops.

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I conti nazionali dell'Italia: una rassegna dei principali avanzamenti

Renato Filosa e Luisa Picozzi

Abstract Starting from the mid 80's, and with an accelerated progression during the past several years, Istat has implemented a series of profound innovations to improve the quantity and quality of its sources of information, the methodologies employed in the production of data, economic and social, the quality and timeliness of the data it disseminates and to ensure transparency of all aspects of its work. Changes in the internal organization, the pervasive use of information technologies, the creation of verifiable archives and the upgrade of methodologies and classifications, allowed Istat to attain best practice standards.
The purpose of the paper is to illustrate both this path and to focus on two major achievements: the establishment of a new fundamental approach to the production of annual National accounts (NA), and the creation of a methodologically correct platform for the estimation of quarterly national accounts (QNA).
We conclude providing some insights about outstanding issues and prospective work.

1 Premessa

Gli anni '80 rappresentano per i conti nazionali un periodo di forti innovazioni, che hanno costituito la base del loro successivo sviluppo fino al periodo più recente: i momenti salienti possono essere individuati nell'inizio della pubblicazione corrente dei conti trimestrali (1985), e nella grande revisione del Pil con l'introduzione delle stime dell'economia sommersa (1987). Nel tracciare un bilancio complessivo della operazione di ammodernamento dei conti nazionali avvenuta in quegli anni, si cerca, in questo lavoro, di mettere in evidenza quanto del progetto originario sia rimasto ancora incompiuto, e quanto sia stato invece addirittura superato dai successivi eventi

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che hanno modificato il ruolo delle stime di contabilità nazionale (Pil e reddito nazionale, indebitamento netto delle amministrazioni pubbliche), mettendole al centro dei processi di valutazione della stabilità finanziaria e della crescita degli stati membri dell'unione europea. Alla fine degli anni '90, il riferimento alle definizioni del Sistema europeo dei conti (Sec95) nei regolamenti comunitari ha reso più stringenti sia gli obblighi di trasmissione dei dati alla Ue, sia la vigilanza sulla qualità delle stime prodotte da parte dell'Eurostat.

Per i conti nazionali dell'Italia il completo adeguamento agli standard internazionali, con l'adozione del Sistema europeo dei conti (SEC), era avvenuto nel corso degli anni '70. All'inizio del decennio successivo l'Italia si presentava allineata ai principali paesi europei per quanto riguardava l'adozione dello schema concettuale e definitorio: venivano pubblicati sia i dati del Pil e delle sue componenti, le tavole input-output, i conti per settore istituzionale, i conti regionali e alcune prime sperimentazioni dei conti trimestrali. A fronte della quantità di informazioni fornite, non veniva però ritenuta soddisfacente la capacità delle stime di misurare l'effettivo peso economico del nostro paese in ambito internazionale, nonché di rappresentare alcune trasformazioni strutturali (decentramento produttivo, crescita di importanza delle piccole imprese, aumento del sommerso) che dalla fine degli anni 60 avevano sensibilmente modificato il sistema economico italiano. Tra gli utilizzatori erano state frequenti le critiche avanzate in merito alla tempestività e alla qualità dei dati e all'adeguatezza delle fonti statistiche utilizzate per costruire le stime (con particolare riguardo alla carenza di indagini sulle piccole imprese).

All'inizio degli anni '80 era stata istituita dal governo italiano una Commissione internazionale, presieduta da sir Claus Moser, con l'incarico di analizzare le statistiche ufficiali del nostro paese e fornire delle linee guida per realizzare una profonda riforma del sistema. Il Rapporto finale della Commissione[2] formulava una serie di raccomandazioni, alcune riferite al miglioramento delle fonti statistiche (archivio delle imprese, sistema degli indicatori di prezzo), altre più specificamente dirette al sistema dei conti nazionali: la necessità di includere nel Pil una stima dell'economia sommersa, lo sviluppo dei conti trimestrali, una analisi più approfondita del settore delle famiglie, il miglioramento delle stime sul settore pubblico.

La risposta della statistica ufficiale alle raccomandazioni del Rapporto Moser si è concretizzata, per quanto riguarda la contabilità nazionale, nell'avvio di un programma di profonda modifica delle basi metodologiche e del processo di produzione delle stime annuali, culminato nella revisione del 1987, e nella realizzazione di un sistema completamente rinnovato di conti trimestrali, la cui pubblicazione è iniziata nel 1985.

Con riferimento ai conti annuali, quella che viene ricordata come la "grande revisione del 1987" ha posto le fondamenta della nuova contabilità nazionale, introducendo un approccio metodologico volto alla ricerca dell'affidabilità e dell'esaustività delle stime attraverso l'integrazione di più fonti statistiche e dati amministrativi.

Il nuovo sistema dei conti trimestrali, nato dalla collaborazione tra l'Istat e la Banca d'Italia, è stato impostato come un sistema integrato, trasparente e replicabile. L'uso di un approccio econometrico basato sulla relazione tra i dati annui dei conti

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[2] Cfr. Istat (1983)

nazionali e gli indicatori congiunturali permetteva non solo di operare la disaggregazione temporale delle stime della contabilità nazionale annuale, ma anche di avere una valutazione statistica dell'affidabilità dei dati della serie storica, comprese le stime in corso d'anno. Alla fine del 1985 è stato dato il via alla pubblicazione corrente di dati trimestrali, con un ritardo medio rispetto al trimestre di riferimento che si è attestato, inizialmente, su valori inferiori ai 100 giorni, ma che è progressivamente diminuito negli anni seguenti, permettendo ai conti trimestrali dell'Italia di essere perfettamente al passo con la tempestività degli altri paesi europei.

Nei paragrafi che seguono ci si concentra sull'analisi dell'effettiva portata innovativa di questi due grandi progetti.

2 La "grande revisione" dei conti del 1987

Dal punto di vista dello schema concettuale e classificatorio, la nuova serie iniziata nel 1987 non presentava differenze rilevanti rispetto alla precedente, in quanto seguiva lo schema del Sistema Europeo dei Conti SEC79; tale schema, nonostante fosse una versione successiva al SEC70, non se ne discostava se non per pochi dettagli; inoltre la classificazione delle attività economiche utilizzata era ancora la Nace-Clio. Le modifiche rispetto alle serie SEC70 già diffuse erano dovute soprattutto ad una più completa aderenza alle definizioni dello schema contabile e della nomenclatura in vigore, frutto del lavoro di analisi ed interpretazione del sistema SEC che nel corso del precedente decennio era stato svolto all'interno dell'Istat.

La vera portata innovativa di questa revisione stava invece nell'approccio metodologico seguito, a sua volta preceduto da una serie di azioni volte ad allargare la base statistica disponibile, e improntato ad un utilizzo integrato delle fonti informative[3]. Le nuove stime si sono appoggiate su un "pilone", costituito dai livelli fissati nella tavola intersettoriale del 1982 (anno di benchmark), per il quale è stato sfruttato tutto il patrimonio di informazioni statistiche allora esistente: i dati del censimento dell'agricoltura, del censimento della popolazione e di quello dell'industria, commercio, servizi e artigianato; i risultati dell'indagine campionaria sui conti delle piccole imprese, riproposta per il 1983 dopo alcuni anni in cui non era più stata effettuata; i dati dell'indagine sulla produzione annuale, che insieme alle rilevazioni sul commercio estero è stata alla base di un dettagliato calcolo della disponibilità dei beni di investimento e di alcune componenti dei consumi. Tra le fonti utilizzate vanno ricordate anche una serie di indagini *ad hoc* effettuate appositamente per le esigenze della contabilità nazionale: l'indagine sulla struttura dei costi delle imprese industriali e di alcune branche dei servizi e alcune indagini speciali campionarie sulle famiglie, come l'indagine sulle manutenzioni delle abitazioni e dei mezzi di trasporto, l'indagine sulle vacanze e quella sui pasti e le consumazioni fuori casa, che investigavano segmenti del sistema produttivo di particolare complessità e difficoltà di misurazione.

[3] La descrizione delle fonti e dei metodi di calcolo impiegati è contenuta nel volume Istat (1990)

2.1 La centralità delle stime dell'input di lavoro e il sommerso

Oltre che attraverso il potenziamento del sistema delle indagini, l'obiettivo di cogliere in maniera il più possibile completa il funzionamento del sistema produttivo è stato realizzato attraverso l'attribuzione di un ruolo centrale ai dati dell'input di lavoro sottostante il prodotto. Le nuove stime dell'occupazione, misurata in unità di lavoro equivalenti a tempo pieno, comprendevano sia le posizioni lavorative regolari, sia quelle per le quali non erano assolti gli obblighi contributivi. Queste stime sono state ottenute attraverso il confronto sistematico e l'integrazione delle fonti statistiche sulle famiglie (che misuravano le persone occupate, sia regolari che irregolari, nell'ipotesi che le famiglie non avessero motivo di nascondere alle autorità statistiche la situazione occupazionale dei loro componenti) e di quelle sulle imprese, che invece rilevavano le posizioni lavorative regolarmente registrate (prime posizioni o posizioni multiple)[4]. Dopo avere effettuato un'analisi della qualità delle fonti disponibili ed avere integrato i dati del censimento della popolazione con quelli dell'indagine sulle forze di lavoro, e dopo avere eliminato le differenze dovute al campo di osservazione delle diverse fonti, alle definizioni e alle classificazioni utilizzate (adottando il concetto di occupazione interna e correggendo l'attività economica dichiarata dalle famiglie laddove si era rivelata scarsamente attendibile), il confronto sistematico effettuato a livello molto disaggregato (per regione e categoria di attività economiche) riusciva a fare emergere le posizioni di lavoro irregolare, dove il dato di fonte famiglia superava quello di fonte impresa, e le posizioni lavorative multiple (nel caso contrario). Con riferimento all'anno di *benchmark,* circa un terzo del valore aggiunto dell'economia era stimato riportando i valori pro capite rilevati dalle indagini sulle imprese dei diversi settori di attività economica all'universo delle unità di lavoro. Questo approccio ha avuto l'approvazione degli organismi comunitari, anche perché costituiva uno dei primi tentativi di produrre stime tra loro coerenti delle voci di conto economico e del principale fattore produttivo impiegato (punti di contatto possono essere individuati con l'elaborazione dei *labour accounts* del CBS olandese, che tuttavia non si spingeva alla ricerca di una completa coerenza con i dati di contabilità nazionale), ed è diventato a metà degli anni '90 uno dei metodi di controllo della esaustività dei dati del prodotto interno lordo raccomandati dalla Commissione europea.

L'altro strumento per rendere le stime esaurienti era costituito dal metodo di correzione dei dati rilevati dalle indagini per l'eventuale sottodichiarazione del fatturato da parte delle imprese. Il modello di rivalutazione si basava sull'assunto che il reddito netto d'impresa dovesse garantire agli indipendenti (imprenditori, titolari e coadiuvanti familiari) una remunerazione non inferiore al reddito percepito da un lavoratore dipendente occupato nella stessa attività economica con analoghe competenze ed analogo orario di lavoro. In caso contrario l'indipendente avrebbe avuto, infatti, la convenienza a modificare il proprio status occupazionale, da indipendente a dipendente, pur di aumentare il proprio reddito da lavoro. Le imprese che riportavano nel questionario di rilevazione dati di conto economico incoerenti con l'ipotesi formulata, erano identificate come sottodichiaranti e quindi sottoposte a rivalutazione. Questo approccio, denominato "*metodo Franz*", dal nome del direttore

[4] Cfr. Pedullà M.G., Pascarella C. Abbate C.C. (1987)

dell'ufficio di statistica austriaco che lo aveva proposto[5], ha suscitato minori consensi rispetto al metodo di stima del lavoro irregolare, ma è stato accettato dalla stessa Unione europea, in alternativa a metodi basati sui dati degli accertamenti fiscali, dopo un ampio dibattito con gli esperti dell'Eurostat, che ha portato i contabili nazionali italiani, come vedremo più avanti, ad affinare ulteriormente le ipotesi sottostanti e le procedure di calcolo.

2.2 Il bilanciamento dei conti

Per il bilanciamento della tavola intersettoriale del 1982 è stata utilizzata per la prima volta una procedura costituita da un adattamento del metodo Stone-Champernowne-Meade (1942) (da qui in avanti SCM), ideato per il bilanciamento di un sistema di contabilità sociale[6]. Tale metodo è stato applicato, in quella occasione, ad uno schema riferito alla sola integrazione dei conti economici con le interdipendenze settoriali: sono state definite le equazioni del sistema e i vincoli contabili da soddisfare. Le parole con cui, nel volume "La nuova contabilità nazionale" del 1990, veniva presentato il sistema di bilanciamento lasciano intuire come il primo utilizzo di tale sistema sia stato soltanto parziale: si diceva, infatti, che il sistema è stato bilanciato "integrando un metodo puramente manuale di ricerca e correzione degli errori … con il metodo simultaneo di minimizzazione di una funzione di perdita quadratica,…. valutando di volta in volta il grado di affidabilità delle stime dirette di ciascuna componente del sistema". Ciò nonostante proprio in quella occasione sono state poste le basi per un impiego regolare di tale strumento nella costruzione delle stime correnti, con una ricaduta positiva in termini di ampliamento e migliore sfruttamento del *set* informativo necessario per le stime correnti e di una maggiore trasparenza nel processo di riconciliazione delle stime della domanda e dell'offerta. Ed è questa la maggiore portata innovativa della revisione del 1987 per quello che attiene al sistema input-output: le discrepanze tra le stime dal lato della domanda e le stime dal lato dell'offerta, generate dall'utilizzo di fonti diverse, affette da errori di misura ed errori campionari possono essere eliminate attraverso un sistema di bilanciamento simultaneo. Il sistema ingloba al suo interno la valutazione dell'affidabilità relativa delle diverse stime effettuata dai contabili nazionali, e rende esplicite le differenze nell'affidabilità dei dati attraverso i valori di una matrice delle varianze avente la stessa struttura e le stesse dimensioni di quella delle stime. Tale matrice è utilizzata per correggere in misura maggiore le stime ritenute meno affidabili (l'entità della correzione dipende naturalmente anche dall'ampiezza delle discrepanze tra risorse e impieghi).

2.3 Le innovazioni riguardanti le valutazioni a prezzi costanti

[5] Il metodo è descritto in Franz A. (1985)

[6] L'algoritmo di bilanciamento si fonda sulla minimizzazione della somma dei quadrati degli scarti tra le stime iniziali e i valori bilanciati dei diversi aggregati, ponderati con la varianza degli errori imputati alle loro stime, nel rispetto dei vincoli contabili in precedenza definiti.

In occasione della revisione del 1987 si è adottato per la prima volta il metodo della doppia deflazione per la stima del valore aggiunto, utilizzando per la deflazione della produzione e dei costi intermedi un sistema integrato di indicatori di prezzo dell'*output* e degli *input*; questi ultimi erano stimati partendo dagli indicatori di prezzo individuati per i prodotti intermedi (separatamente per la quota di produzione interna e di importazione), aggregati per mezzo di coefficienti di ponderazione desunti dalla struttura dei costi dell'ultima tavola I/O disponibile. Già nel rapporto Moser si faceva riferimento alla necessità di costruire un sistema dei prezzi (sia alla fase della produzione, che alla fase del consumo) che utilizzasse i dati della contabilità nazionale per il sistema di ponderazione degli indici. La costruzione delle informazioni necessarie per la stima del valore aggiunto a prezzi costanti con il sistema della doppia deflazione, andava nella stessa direzione, costringendo, anzi, a integrare subito attraverso stime *ad hoc* (in particolar modo per i servizi) le informazioni che ancora mancavano per il completamento del sistema dei prezzi auspicato da Moser, in un quadro di coerenza dato dalla tavola intersettoriale.

2.4 L'aggiornamento delle stime e la ricostruzione delle serie storiche

La metodologia di stima utilizzata per il benchmark 1982 ha potuto essere replicata in forma semplificata per la costruzione delle stime correnti grazie alla disponibilità di fonti statistiche a cadenza annuale: per esempio in luogo dei censimenti della popolazione e delle attività produttive le fonti che da allora vengono integrate e confrontate annualmente sono costituite dalla indagine sulle forze di lavoro, dall'archivio delle imprese (che negli anni '90 è stato profondamente ristrutturato) e dai dati amministrativi dell'INPS. Questo approccio, unitamente al sistema di correzione per la sottodichiarazione da parte delle imprese, replicato ogni anno, ha consentito di mantenere la centralità del ruolo delle stime delle unità di lavoro per la costruzione del PIL e di incorporare anche nelle stime correnti una valutazione dell'economia sommersa, permettendo di arrivare ad una quantificazione annuale del suo peso sia in termini di occupazione che di valore aggiunto.

Le stime della revisione del 1987 hanno rappresentato una netta rottura rispetto alle serie precedenti; si è posto quindi il problema di utilizzare tutto il patrimonio informativo disponibile in precedenza per ricostruire le serie storiche: non solo le serie annuali per le branche di attività economica, ma anche i conti per settore istituzionale, i conti regionali e i conti trimestrali. Questo programma ha richiesto alcuni anni per essere realizzato. In particolare, nel 1990 è stata pubblicata la ricostruzione delle serie storiche dei conti nazionali per il periodo 1970-1979[7], coerente con le stime prodotte in occasione della revisione del 1987. Anche questa ricostruzione ha comportato una completa rivisitazione delle fonti statistiche usate e l'applicazione di una metodologia analoga (anche se applicata con minore dettaglio) a quella adottata per il benchmark 1982. Nell'ambito di questo lavoro le due caratteristiche più rilevanti sono state proprio il tentativo di effettuare un bilanciamento disaggregato tra risorse e impieghi

[7] La descrizione dettagliata della metodologia della ricostruzione è contenuta in Giovannini E. (a cura di) (1994)

per l'intera serie storica e l'utilizzo della doppia deflazione per la stima del valore aggiunto a prezzi costanti.

2.5 Gli sviluppi successivi dei conti annuali e l'eredità della revisione del 1987

Nel ventennio seguente vi sono state quattro revisioni generali dei conti (negli anni 1991, 1996, 1999, 2005)[8], tutte seguite da una completa ricostruzione sia delle serie storiche per branca di attività economica, sia delle articolazioni per settore istituzionale e per livello territoriale. Lo schema delle revisioni generali e delle loro caratteristiche è riportato nella figura 1.

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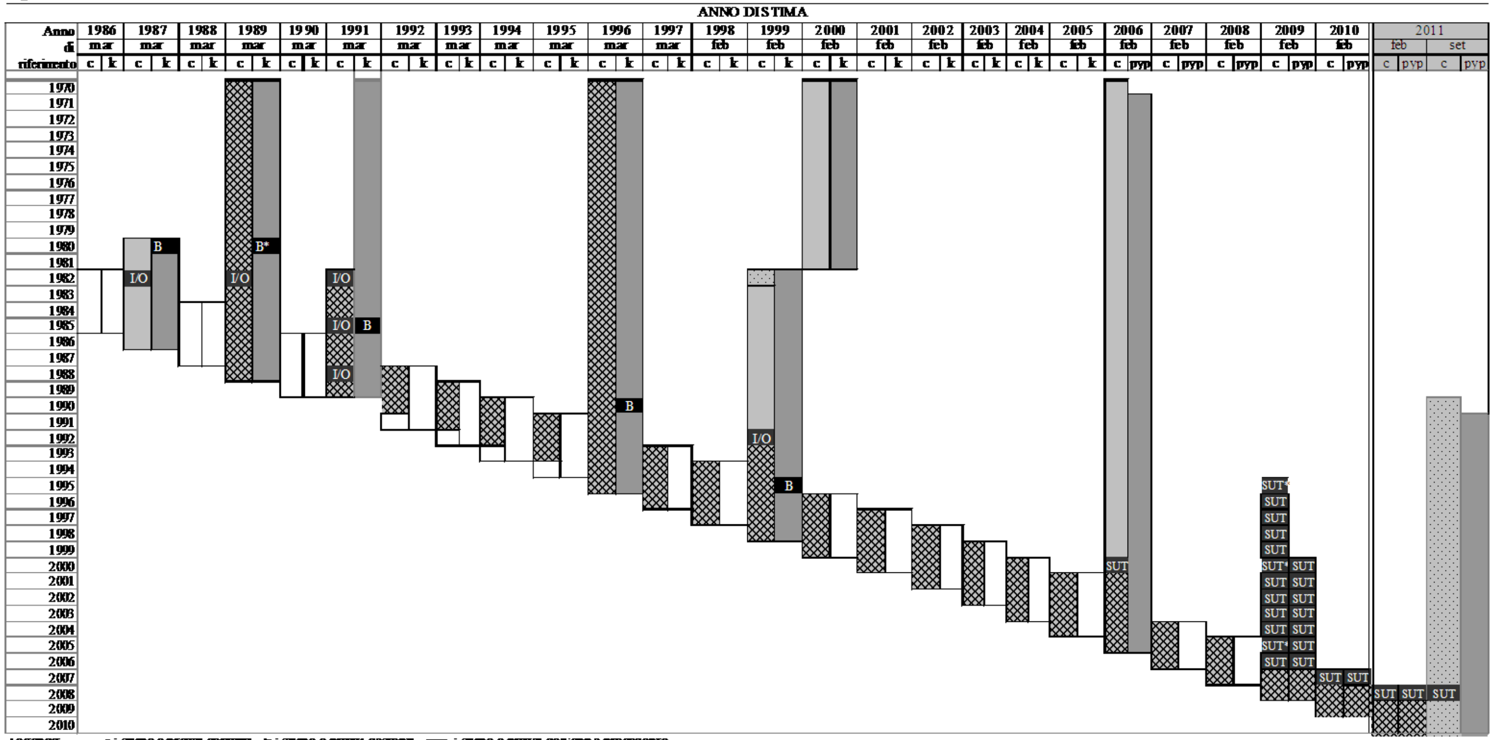
[8] Cfr. Istat (1997), Istat (2004) e Istat (2006)

Fig. 1 - Schema delle revisioni generali e dei conti economici annuali.



Legenda c : stime a prezzi correnti k : stime a prezzi costanti pyp : stime a prezzi dell'anno precedente

- I/O Anno per il quale è disponibile una I/O (a prezzi correnti)
- SUT Anno per il quale è disponibile una SUT (a prezzi correnti e ai prezzi dell'anno precedente)
- Aggiornamento o ricostruzione delle stime con bilanciamento aggregato
- Ricostruzione delle stime a prezzi correnti (senza bilanciamento)
- B Anno base delle valutazioni a prezzi costanti
- Aggiornamento o ricostruzione delle stime con bilanciamento
- Aggiornamento stime a prezzi correnti senza bilanciamento
- Ricostruzione delle stime in volume (senza bilanciamento)

Anni di stima 1986-1998: classificazione Nace-Clio
Anni di stima 2006-2011 (marzo): classificazione Nace Rev.1.1
Anni di stima 1999-2005: classificazione Nace Rev.1
Anni di stima dal 2011 (settembre) in poi: classificazione Nace Rev.2

2.5.1 Gli anni '90

La prima di queste revisioni generali, avvenuta nel 1991, è stata effettuata per riallineare le stime correnti ai risultati delle tavole input-output del 1985 e del 1988 e per aggiornare al 1985 l'anno base delle valutazioni a prezzi costanti. Alla stima della Tavola delle transazioni intersettoriali (TEI) 1982 ha fatto, infatti, seguito la costruzione di due nuove TEI per il 1985 e il 1988; per entrambe le tavole e per l'elaborazione delle stime a cadenza annuale ci si è basati su indagini ripetute nel tempo sulle piccole imprese e su un aggiornamento dell'archivio delle unità produttive e dei relativi addetti, anche se limitato alle imprese con oltre 10 addetti. In questo periodo è stato, inoltre, completato il processo di informatizzazione di tutte le procedure di calcolo, che ha determinato negli anni successivi un guadagno in tempestività, trasparenza e flessibilità nell'organizzazione del lavoro. Dall'inizio degli anni '90 il bilanciamento dei conti è stato fatto annualmente nell'ambito di uno schema *input-output*, introducendo gradualmente successivi affinamenti: per gli anni non di benchmark restava limitato ai flussi totali e ai prezzi di mercato (non erano stimate cioè né la matrice delle importazioni, né quelle dei margini, dell'Iva e delle imposte nette).

La seconda revisione generale, pubblicata nel 1996, che ha coinciso con l'adozione della base 1990, ha avuto obiettivi più ambiziosi: quello di assicurare la piena coerenza tra i dati della contabilità nazionale e le nuove serie della Bilancia dei Pagamenti, stimate dalla Banca d'Italia nel 1994, e di introdurre alcuni sostanziali miglioramenti alle stime dei servizi prodotti dalle abitazioni e degli ammortamenti per la branca dei servizi non vendibili delle Amministrazioni Pubbliche (Ap). Nella successiva ricostruzione delle serie storiche, per tutti gli anni a partire dal 1970, è stato effettuato il bilanciamento delle stime iniziali delle risorse e degli impieghi nell'ambito di uno schema input-output a prezzi di mercato (flussi totali), sempre sulla base del metodo SCM.

2.5.2 Il passaggio al SEC95 e la situazione attuale

La terza revisione generale, quella del 1999 è stata caratterizzata dal passaggio al SEC95, dall'adozione della classificazione delle attività economiche Nace Rev.1, nonché da un utilizzo di nuove e più dettagliate fonti (tra cui quelle censuarie). L'anno di benchmark è stato il 1992, prossimo agli anni dei censimenti generali e con riferimento al quale sono state effettuate, appositamente per la contabilità nazionale, una indagine sulla struttura dei costi delle imprese e una analoga rilevazione, di carattere sperimentale, per le Amministrazioni pubbliche.

Il quadro informativo delle fonti statistiche alla fine degli anni novanta si è presentato arricchito in modo sostanziale rispetto all'inizio del decennio: la messa a punto (nel 1996) di un nuovo archivio statistico delle imprese attive (l'archivio ASIA), aggiornato annualmente attraverso l'incrocio di più fonti statistiche e amministrative, la disponibilità di indagini annuali sui conti delle imprese estese a tutti i settori di attività e a tutte le classi dimensionali, hanno elevato, rispetto al passato, la numerosità e la qualità delle fonti dal lato dell'offerta. La ristrutturazione delle indagini sulle forze di lavoro nel 1992 e sui consumi delle famiglie (nel 1997), e la maggiore disponibilità di indagini sui comportamenti sociali hanno aumentato la possibilità di utilizzare le fonti statistiche sulle famiglie nella costruzione delle stime dell'occupazione e della domanda finale. E' stato, inoltre, fatto maggior ricorso rispetto al passato alle fonti amministrative, ed in particolare ai dati dell'INPS. Per quanto riguarda le valutazioni a prezzi costanti, l'Istat ha continuato a pubblicare i dati secondo un sistema a base fissa, aggiornando la base al 1995.

Il SEC95 ha rappresentato un cambiamento sostanziale rispetto all'architettura dei conti e alle definizioni che erano state alla base della revisione del 1987: dalla definizione degli operatori economici (le unità istituzionali e i loro raggruppamenti nei settori istituzionali), al nuovo modo di rappresentare l'articolazione settoriale dell'economia secondo la Nace Rev.1. Con il sistema delle interdipendenze settoriali, che nel SEC95 è costituito dalle tavole *supply and use,* è stata introdotta una distinzione tra unità di osservazione (l'unità di attività economica a livello locale - UAEL - che può coincidere con una unità istituzionale o con una parte di questa e che, oltre all'attività principale, può avere una o più attività secondarie), e unità di analisi (l'unità di produzione omogenea - UPOL - che individua un particolare processo produttivo che dà luogo ad un unico *output* definito secondo la classificazione CPA dei prodotti e corrisponde alla definizione presente nella versione precedente del SEC). I raggruppamenti di UAEL danno luogo alle branche di attività economica e i raggruppamenti di UPOL alle branche di produzione omogenea (prodotti). Le tavole *supply and use* sono, appunto, matrici costruite per branca di attività economica e per prodotto.

Con il SEC95 la definizione della produzione si amplia, così come quella di investimento[9]. E' inoltre introdotto, accanto al concetto di spesa delle famiglie, il concetto di consumo effettivo (*actual consumption*), che comprende i trasferimenti sociali in natura, cioè quei beni e servizi a carattere individuale che le Amministrazioni pubbliche e le Istituzioni sociali private mettono direttamente a disposizione delle famiglie: l'importanza di questa posta è stata recentemente "riscoperta" nel quadro del dibattito sugli indicatori di benessere[10].

L'ultima revisione generale in ordine di tempo è quella che ha avuto luogo nel 2005-2006, basata sull'anno di benchmark 2000 e sulla classificazione Nace Rev.1.1, versione aggiornata, ma non sostanzialmente differente, della Nace Rev.1. Questa revisione generale, a differenza delle precedenti, si è avvalsa solo in parte dei risultati di indagini effettuate *ad hoc* per le esigenze della contabilità nazionale, ma ha sfruttato soprattutto l'accresciuta disponibilità delle informazioni prodotte nell'ambito del Sistema statistico nazionale, sia in attuazione di regolamenti comunitari, sia come

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[9] Sono registrati gli scambi tra UAEL di una stessa impresa, sono considerati *output* di un processo produttivo sia gli originali di opere artistiche, letterarie o di intrattenimento, sia i servizi legati alla loro utilizzazione, è più estesa la definizione del servizio assicurativo, e quella dei beni ammortizzabili. Nell'ambito degli investimenti fissi lordi sono ora inclusi i cosiddetti beni immateriali prodotti, i quali comprendono, oltre agli originali di opere artistiche, letterarie o di intrattenimento sopra citati, anche il software e le prospezioni minerarie.

[10] Il rapporto finale della "Task Force on the Household Perspective", istituita dall'Eurostat per individuare, nell'ambito degli schemi di contabilità nazionale, indicatori utili per valutare il benessere delle famiglie, include tra le sue raccomandazioni l'impiego di una misura del reddito disponibile comprensivo dei trasferimenti sociali in natura. Cfr. Eurostat (2011).

elaborazione statistica di dati provenienti da archivi amministrativi[11]. Nella costruzione dei nuovi conti, in cui sono, tra l'altro, incorporati i risultati dei censimenti generali del 2000-2001, del censimento sul settore non profit nel 1999 e della nuova indagine continua sulle forze di lavoro, sono state introdotte alcune modifiche di rilievo al trattamento dei dati delle indagini sulle imprese, improntate al principio di migliorare l'accuratezza delle stime per gli specifici domini di analisi di contabilità nazionale, garantendo al contempo una buona coerenza con i livelli rilevati dalle indagini. Anche il metodo di rivalutazione del valore aggiunto è stato modificato, mantenendo la medesima struttura teorica del precedente, ma ridefinendo l'universo delle imprese sottoposte a rivalutazione, le variabili di stratificazione e calcolando con riferimento allo strato (e non più alla singola unità produttiva) il reddito da lavoro dipendente pro capite da utilizzare per il confronto con il reddito netto d'impresa.

Con le nuove stime è stata data attuazione ad alcune importanti normative comunitarie: il nuovo trattamento dei Servizi di intermediazione finanziaria indirettamente misurati (Sifim), che prevede l'attribuzione del consumo del servizio di intermediazione finanziaria ai diversi operatori economici (e quindi sia ad usi intermedi che finali); il passaggio da uno schema *input-output* ad uno *supply and use* (SUT), che costituisce in realtà un completamento dell'applicazione del SEC95, che nella revisione del 1999 non si era potuto realizzare. Il bilanciamento annuale dei conti è stato così effettuato nel quadro di uno schema completo *supply and use*, consentendo di pubblicare nel 2007 una serie storica di tavole dal 2000, riempiendo un vuoto informativo che molti utilizzatori lamentavano da tempo.

Per quanto riguarda il sistema delle valutazioni in termini di volume, si è finalmente abbandonato il sistema a base fissa, che tanta insoddisfazione aveva generato tra gli utilizzatori, per passare all'uso di indici concatenati. Già il SEC95 raccomandava questo approccio, ma solo con la Decisione della Commissione Ue 98/715 sui principi da seguire nelle valutazioni a prezzi costanti (rilevanti ai fini dell'applicazione del patto di stabilità) è stato imposto il passaggio al sistema del concatenamento per tutti i paesi europei entro il 2005: come anno di riferimento per le serie concatenate è stato scelto il 2000.

In definitiva, l''impostazione attualmente adottata per la stima del PIL si ricollega a quella che è stata alla base della revisione del 1987 per quanto riguarda alcune scelte metodologiche fondamentali:

- stima dell'input di lavoro (unità di lavoro) ottenuta attraverso l'integrazione tra fonti dal lato della domanda di lavoro (imprese) e fonti demografiche;
- stima dal lato della formazione del prodotto basata in parte sul metodo del riporto all'universo dei valori pro-capite delle indagini mediante le stime delle unità di lavoro;
- stima della domanda interna basata sull'integrazione del calcolo della disponibilità dei prodotti con dati di spesa;
- uso dei dati dei bilanci per le Amministrazioni pubbliche, per le Istituzioni finanziarie e per le grandi società pubbliche e private[12];

[11] In particolare, si ricordano l'Archivio dei DM10 dell'INPS, e l'archivio degli Studi di Settore dell'Agenzia delle Entrate.

[12] Nel caso delle grandi imprese pubbliche e private l'utilizzo dei bilanci è finalizzato ad una analisi più approfondita di quella che può essere condotta sui dati di indagine.

- uso prevalente di un sistema “prezzi per quantità” per l'agricoltura, l'energia e parzialmente per le costruzioni;
- integrazione tra le statistiche del commercio con l'estero e della bilancia dei pagamenti per la stima dei flussi del conto del resto del mondo;

Le maggiori differenze rispetto al 1987 risiedono quindi nel sistema contabile di riferimento, nel trattamento dei dati di base, nell’uso degli indici concatenati per la stima delle variazioni di volume, nel dettaglio e nella differente forma del bilanciamento, che avviene ora annualmente nell’ambito di uno schema SUT sia a prezzi correnti che ai prezzi dell’anno precedente. Per l’anno della stima definitiva (a t+36 mesi) il bilanciamento delle stime a prezzi correnti è effettuato attraverso la costruzione di un sistema completo di matrici ausiliarie (delle importazioni, dei margini di commercio e di trasporto per tipologia di servizio, delle imposte indirette nette e dell’IVA).

3. La contabilità nazionale trimestrale

3.1 Le origini

La produzione dei dati della contabilità nazionale trimestrale (CNT) risale, in Italia, ai primi anni ottanta. In quegli anni l’uso ormai consolidato dei dati annuali per scopi di public policy (analisi e previsione), era divenuto insufficiente, così come stava avvenendo nei principali paesi, e si affermava, quindi la necessità di disporre di dati che consentissero di valutare con maggiore tempestività l’evoluzione del ciclo economico in corso d’anno. La produzione della CNT dell’Istat coesisteva con la diffusione dei principali aggregati da parte dell’Isco. Allo stesso tempo, altri enti, principalmente la Banca d’Italia, avevano iniziato, con proprie metodologie, la produzione di stime trimestrali di alcuni aggregati che venivano utilizzati, insieme ai dati dell’Isco, per la gestione della politica monetaria e per scopi di ricerca, principalmente la costruzione di un modello econometrico trimestrale dell’economia italiana. Nel contesto internazionale i dati della CNT italiana pubblicati dall’OCSE erano quelli dell’Isco.

La simultanea presenza di più stime trimestrali della contabilità nazionale, e soprattutto l’uso dei dati Isco da parte degli organismi internazionali, era il sintomo di una diffusa perplessità circa la qualità dei dati pubblicati dall’Istat, e cioè dei dubbi sorti dall’osservazione di un’eccessiva erraticità delle serie e della scarsa trasparenza del relativo processo produttivo.

Come conseguenza, nel 1983, si assegnò un’elevata priorità all’adeguamento dell’architettura dei conti e delle metodologie di calcolo a quella prevalente in sede europea e ONU. Venne, in altri termini, avvertita dall’Istat la necessità di riaffermare il duplice ruolo di esclusivo produttore delle statistiche nazionali e di credibile attore nella preparazione delle decisioni della politica economica e nella verifica ex-post degli indirizzi perseguiti. L’adeguamento alla best practice internazionale, e cioè l'impiego di metodi statistici d'avanguardia e l'adozione standard di elevata trasparenza, divenne una priorità ineludibile.

Il nuovo assetto della CNT fu realizzato fissando e perseguendo una serie ben definita di obiettivi.

In primo luogo si provvide ad un accurato esame dei metodi e delle norme seguite da tutti i principali paesi, soprattutto da quelli i cui uffici statistici centrali godevano di un'indiscussa reputazione internazionale. Tale esame fu eseguito attraverso lo studio delle pubblicazioni sull'argomento sia dei singoli paesi che degli organismi internazionali (CEE, IMF e, ovviamente, OCSE). Oltre all'esame delle fonti e dei metodi, furono effettuate comparazioni sul grado di disaggregazione del conti pubblicati e si raggiunse alla conclusione che il livello di articolazione settoriale dell'Istat avrebbe potuto essere ben più ampio di quello di molti altri paesi.

In secondo luogo preminente fu l'obiettivo di un adeguamento agli standard dei paesi più progrediti anche con riferimento ai metodi matematico-statistici impiegati per la disaggregazione temporale delle serie dei conti annuali. L'attenzione ancora oggi posta su questo tema mostra che un fondamentale obiettivo della revisione del 1985 era quello di applicare metodologie che riproducessero in modo non distorto le caratteristiche stagionali e cicliche degli indicatori di riferimento, e che, al contempo fossero capaci di produrre estrapolazioni affidabili in corso d'anno. Ciascun metodo, infatti, può dar luogo a distorsioni qualora vi siano discrepanze elevate fra i dati annui delle variabili da ripartire a cadenza infrannuale e le somme (medie) annue degli indicatori. L'Italia, in particolare, faceva uso del metodo Bassie il quale era caratterizzato da importanti manchevolezze. Infatti, esso genera distorsioni nella stima della stagionalità e della dinamica ciclica della serie trimestralizzate quando le discrepanze sono elevate. Inoltre, il metodo non consente di stimare il primo anno dei dati del campione e, soprattutto, non permette estrapolazioni in corso d'anno, ossia quando ancora non si conosce il valore annuo delle variabili da trimestralizzare. Manchevolezze, queste, che erano all'origine del diffuso scetticismo degli utilizzatori circa la qualità dei dati Istat e che determinarono la decisione di abbandonare quel metodo. Per motivi analoghi fu deciso di non adottare un altro metodo all'epoca impiegato, quello proposto da Denton. Questo metodo, infatti, non permette di minimizzare gli scarti fra i dati annuali della variabile da trimestralizzare (sia questa X) e l'indicatore (sia questo z) se $X=a+bz+u$ dove $b\neq 1$. Il fatto che normalmente sia $b\neq 1$ contraddice l'assunto di Denton rendendolo inadatto ai fini della trimestralizzazione dei conti nazionali. La scelta, come è noto, cadde sul metodo econometrico di Chow e Lin che minimizza le discrepanze annuali e permette un'agevole estrapolazione dei dati basata sul valore medio del coefficiente che lega variabile e indicatore. La variante del metodo adottata fu quella predisposta e utilizzata dalla Banca d'Italia per i suoi lavori interni[13]. Una scelta la cui bontà è stata confermata da un soddisfacente uso venticinquennale e che, ancora oggi, è riflessa nella pratica internazionale. Sempre avendo riguardo alla metodologia, l'Istat adottò un metodo di destagionalizzazione delle serie all'avanguardia in quegli anni, il metodo X11 Arima, aderendo alle raccomandazioni fatte nel contesto del progetto DESEC organizzato e diretto dal Prof. Domenico Piccolo[14]. Tale metodo era allora

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[13] Cfr. Barbone L., Bodo G., , Visco I. (1981).

[14] Tra le attività del progetto va ricordata l'analisi e il confronto dei principali metodi di destagionalizzazione allora utilizzati da istituti di statistica o di ricerca ed enti internazionali. Cfr. Piccolo D. (1985),

impiegato nei paesi statisticamente più avanzati, come l'ufficio statistico nazionale del Canada.

L'adeguamento al quadro contabile europeo e dell'ONU, il perseguimento della best practice internazionale e l'uso di procedure statistiche avanzate non furono i soli, ancorché principali, obiettivi della revisione. Fu stabilito di istituire un archivio elettronico dei dati di input e di output (anche se non proprio un data base come lo intendiamo oggi) che fosse continuamente aggiornato e interrogabile e che consentisse la verificabilità dei dati. Un obiettivo che la Commissione che ha riesaminato nel 2005 le metodologie di trimestralizzazione ha esplicitamente apprezzato.

Infine, il progetto di revisione si pose il fine, fortemente voluto dall'Istat, di assicurare la più ampia trasparenza. Nel 1985 fu resa pubblica una puntigliosa descrizione degli indicatori utilizzati per ogni singola variabile[15], descrivendone eventuali manchevolezze e gli eventuali accorgimenti utilizzati per alleviarne gli effetti (per esempio rendendo esplicito l'uso di eventuali variabili di comodo e descrivendone la tipologia).

Il conseguimento di questi obiettivi è provato dall'uso venticinquennale dell'impianto originale, che in larga misura è stato recentemente confermato. Ad esso, ovviamente sono stati apportati cambiamenti che sono descritti e commentati nei paragrafi che seguono.

3.2 L'ampliamento della base informativa

Se si confronta la base di dati di allora con quella attuale si ricava l'impressione che quella del 1985 fu solo l'insieme minimo di dati necessari alla produzione di stime affidabili, ma tale era all'epoca tutto (o quasi) quello che assicurava un soddisfacente grado di fiducia nella loro qualità.

Fare un resoconto dettagliato di tutti i miglioramenti qualitativi e quantitativi apportati alla base di dati è fuori delle finalità di questo scritto, essendo numerose le fonti Istat che danno conto delle modifiche. Le innovazioni hanno riguardato l'abbandono di indicatori poco affidabili, l'introduzione di nuove informazioni per il settore terziario, l'impiego congiunto di vecchi indicatori con altri, come è avvenuto per i consumi delle famiglie[16], una nuova stima degli investimenti in costruzioni[17]. Due sono, però, i mutamenti di maggior momento che occorre sottolineare: la stima del valore aggiunto ottenuta con la doppia deflazione e la misura dell'input di lavoro, una variabile, quest'ultima, interessata da mutamenti importanti sui quali l'Istat ha concentrato la dovuta attenzione.

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[15] V. Istat (1985).

[16] E' questo per esempio il caso dei consumi delle famiglie dove accanto ai dati dell'indagine campionaria sono usati anche indicatori di disponibilità. In realtà l'indagine campionaria, specie se ci si spinge ad un elevato grado di disaggregazione, può presentare profili anche molto erratici e ciò può rendere necessario conferire maggiore stabilità alle stime.

[17] Il nuovo indicatore di produzione del settore è costruito sulla base di una funzione di produzione che usa come indici di *input* i prodotti intermedi destinati all'industria delle costruzioni, le ore lavorate (stimate ricorrendo a informazioni provenienti dalle Casse edili) e una stima del capitale fisso che deriva dalla elaborazione della contabilità annuale. In prospettiva la produzione del settore dovrà distinguere fra edilizia residenziale, non residenziale e produzioni per il comparto del genio civile.

Nel 1985 il valore aggiunto trimestrale a prezzi correnti era stimato a partire da quello a prezzi costanti inflazionato con un indice dei prezzi all'ingrosso. Successivamente si introdussero dei correttivi per tenere conto della variazione delle ragioni di scambio tra output e input[18]. La procedura rimaneva comunque alquanto elementare e certamente lontana dalla metodologia impiegata nella preparazione dei conti annuali. Per avvicinare in questo settore le due metodologie di calcolo si è passati con la successiva revisione generale[19] al metodo della doppia deflazione, procedendo alla stima trimestrale della produzione e dei costi intermedi, con un accresciuto grado di disaggregazione settoriale rispetto al passato, utilizzando come indicatori per la deflazione le statistiche dei prezzi dell'output venduto sul mercato interno, gli indici dei valori medi unitari delle esportazioni e delle importazioni e impiegando le informazioni della matrice delle interdipendenze settoriali per definire i rapporti strutturali tra produzione, consumi intermedi e valore aggiunto e per stimare i prezzi dell'input.

Nel 2005 si è passati, per l'intero sistema dei conti, sia annuali che trimestrali, da un sistema di stime a prezzi costanti, con base fissa, a un sistema di indici a catena. La citata decisione Ue 98/715 sulle misure di prezzo e volume, che raccomandava l'abbandono del sistema a base fissa per l'adozione del metodo del concatenamento, non si applicava direttamente alla contabilità trimestrale; tuttavia veniva ribadito in quella sede il principio fondamentale della coerenza con i conti annuale, "affinché i conti trimestrali possano consentire di prevedere i risultati definitivi nel modo più preciso possibile …". In occasione del passaggio alla tecnica del concatenamento, anche la procedura della doppia deflazione ha subito alcune modifiche: gli utilizzatori non hanno lamentato particolari inconvenienti nell'impiego dei nuovi dati.

Ugualmente radicale è il cambiamento che ha interessato la costruzione dei dati del mercato del lavoro sia a cadenza annuale che, ovviamente, a frequenza trimestrale per adeguare l'evidenza statistica al passo, accelerato, dei mutamenti che hanno avuto luogo nel settore L'innovazione è stata cioè finalizzata a distinguere i lavoratori dipendenti da quelli indipendenti, quelli residenti da quelli non residenti, quelli regolari da quelli irregolari, quelli a tempo parziale da quelli a tempo pieno, i lavoratori in cassa integrazione e, infine, meglio rilevare l'orario di lavoro delle unità lavorative. Ciò ha richiesto di modificare le indagini, di effettuarne di nuove e di fare un più intenso uso di dati amministrativi. Le fonti informative utilizzate per la stima trimestrale dell'input di lavoro sono pertanto divenute molto più numerose rispetto al passato, hanno una tempistica più soddisfacente e si differenziano in base alle varie tipologie di occupazione. Il conseguente ampliamento dell'informazione statistica ha permesso la pubblicazione in serie storica (a partire dagli anni settanta e successivamente dagli anni ottanta) delle stime trimestrali distinte per posizione nella professione e per branca di attività economica delle unità di lavoro (equivalenti a tempo pieno) e degli occupati interni.

Ciò ha richiesto diverse modifiche alle indagini trimestrali già esistenti, la più importante delle quali è naturalmente quella dell'indagine sulle Forze di Lavoro che storicamente contribuisce a stimare la parte più consistente dell'occupazione di contabilità nazionale e cioè la quota degli occupati regolari e quella degli occupati non regolari (non registrati dalle imprese e non visibili alle istituzioni previdenziali e

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[18] Cfr. Istat (1987).

[19] V. Istat (1992), in cui è descritto il lavoro effettuato per la ricostruzione dei conti trimestrali in base '80.

fiscali). Quest'indagine rappresenta la principale base informativa anche per la stima trimestrale delle ore pro capite effettivamente lavorate. L'indagine ha subito nel corso degli anni diverse modifiche. La più recente (2004) ha trasformato l'indagine in una rilevazione continua basata su interviste settimanali e non più trimestrali come nel passato, che assicurano stime più robuste e più rappresentative del fenomeno occupazione. Per quanto riguarda le ore lavorate sono disponibili (a partire dal 2008) anche le serie trimestrali del monte ore effettivamente lavorate che permettono la comparabilità internazionale delle stime sulla produttività del lavoro.

A partire dal 2003, con la rilevazione OROS (Occupazione, Retribuzioni e Oneri Sociali), sono stati introdotti dati sulle retribuzioni, oneri sociali e costo del lavoro per Unità di lavoro equivalenti a tempo pieno, che rappresentano una base informativa importante sia per la trimestralizzazione dell'occupazione relativa ai dipendenti regolari nell'industria in senso stretto, sia per la trimestralizzazione delle retribuzioni e oneri sociali. La rilevazione si basa sull'integrazione dei dati amministrativi di fonte Inps tratti dalle dichiarazioni contributive DM10 con informazioni derivanti dall'indagine mensile dell'Istat su Lavoro e retribuzioni nelle grandi imprese. L'Inps fornisce inoltre indicatori utili sia per la trimestralizzazione degli occupati in cassa integrazione (Cig), tramite l'informazione riguardante le ore autorizzate per Cig ordinaria, straordinaria e in deroga, sia per la trimestralizzazione degli occupati con contratti di lavoro a tempo parziale tramite l'indicatore delle ore lavorate nelle posizioni a tempo parziale.

I dipendenti del settore del credito e della pubblica amministrazione vengono trimestralizzati con degli indicatori specifici. La Banca d'Italia fornisce trimestralmente i dati relativi ai dipendenti nel settore del credito, mentre gli indicatori congiunturali del settore della pubblica amministrazione sono desunti dalle stime provvisorie incluse nei documenti di programmazione economica e finanziaria.

Naturalmente, il più ampio dettaglio informativo è limitato al periodo più recente. La necessità di disporre di serie storiche lunghe ha portato ad effettuare ricostruzioni all'indietro utilizzando fonti meno articolate, superare interruzioni di serie che hanno riguardato i diversi settori di attività e differenze di classificazione fra le differenti fonti statistiche e quelle in uso dalla contabilità nazionale. Ma questo processo di complessa integrazione delle fonti è ineludibile se si persegue il miglioramento dell'informazione statistica, e non impedisce di formulare, a giudizio degli scriventi, una valutazione positiva dei progressi acquisiti circa la conoscenza dei cambiamenti continui e spesso radicali che interessano il mercato del lavoro.

3.3 Innovazioni nelle metodologie

Le innovazioni apportate alle metodologie di calcolo delle serie trimestrali sono principalmente due. Quella più radicale riguarda la procedura di destagionalizzazione e quella di portata minore riguarda il metodo di trimestralizzazione delle serie annuali.

3.3.1 La procedura di destagionalizzazione

L'aggiornamento delle procedure di destagionalizzazione da parte dell'Istat segue una prassi consolidata: essa avviene sempre in consultazione e sotto la guida della comunità accademica e con la collaborazione degli utilizzatori. L'uso della procedura X11 Arima (X11A) venne deciso sulla base delle raccomandazioni del progetto DESEC (1982-85) e quelle del gruppo di Ricerca SIS – Istat del 1992-95. Il passaggio all'impiego della procedura Tramo-Seats (TS) è conforme alle raccomandazioni del progetto SARA del 2000[20].

Le motivazioni che sono alla base del periodico aggiornamento delle procedure sono essenzialmente due. In primo luogo quella di impiegare metodi che sono concordati con l'Europa nel contesto dell'armonizzazione delle statistiche economiche. Si risponde, così, ad impegni istituzionali. Una seconda motivazione è quella di carattere operativo consistente nell' adottare procedure fondate su scelte teoriche solide che permettano di evitare, nella misura del possibile, interpretazioni distorte delle variazioni di breve periodo delle serie economiche. Approcci diversi alla destagionalizzazione possono, infatti, condurre a serie destagionalizzate aventi dinamiche di breve periodo differenti che rendono problematica l'analisi congiunturale.

Le finalità del progetto SARA è dunque consistita nel ricercare un punto di equilibrio fra la necessità di disporre di una decomposizione perfetta delle serie nelle loro componenti (ciclo-trend, stagionalità e componenti irregolari), che è impossibile da conseguire, e quello di disporre di una procedura statistica basata sulla teoria. La scelta di sostituire TS a X11A è dovuta al tentativo di superare alcuni limiti operativi di X11A. TS consentirebbe di migliorare il trattamento preliminare dei dati poiché la stima del ciclo trend e della stagionalità è possibile solo se la serie è generata da un processo gaussiano. Metodi che non rilevano correttamente outliers e componenti irregolari producono serie destagionalizzate distorte. La seconda ragione che ha portato alla scelta di TS è che questa procedura consente maggiori scelte model based. Le procedure automatiche di X11A e di TS, infatti, danno risultati soddisfacenti solo per una percentuale (si stima 50%) delle serie economiche. Naturalmente questo ha richiesto all'Istat, e richiederà in futuro, un processo di apprendimento costoso in considerazione dell'elevatissimo numero delle serie da destagionalizzare. Sperimentazioni svolte nel contesto del progetto SARA hanno riguardato, perciò, l'identificazione degli outliers (e le differenze di calendario[21]) la cui rimozione, evitando o riducendo le distorsioni migliora anche le capacità di previsione del modello per le estrapolazioni in corso d'anno. Una fase operativa, questa, dalla quale dipende molto la credibilità della CNT.

La sperimentazione, in realtà, conferma che le due procedure a confronto, X11A e TS, hanno entrambe routines capaci di trattare adeguatamente le diverse tipologie di

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[20] Cfr. Piccolo D. (2000).

[21] L'Istat ha abbandonato il sistema di correzione proporzionale degli effetti di calendario (in base al quale la correzione avveniva correggendo i dati mensili in base al rapporto tra i giorni lavorativi del mese e quello medio dell'anno base) utilizzato, peraltro, solo con riferimento all'indice della produzione industriale, perché tale operazione portava, nel caso di bassi livelli di attività, ad una sovra correzione dei dati. Al suo posto è stata adottata una metodologia di correzione basata sul modello di regressione: gli effetti sono colti attraverso i coefficienti di regressione stimati di variabili costruite ad hoc sulla base della struttura del calendario nel tempo. Per una descrizione completa del complesso procedimento di stima e della sua applicazione ai CNT si rinvia a Di Palma F. e Marini M. (2004).

outliers (salti di serie occasionali e temporanei, cambiamenti di livello temporanei o tendenziali). Ma il trattamento automatico, come già osservato, non è sempre soddisfacente, nel senso che in taluni casi i metodi automatici possono individuare come comportamenti irregolari quelle che in realtà sono variazioni stagionali. Un difetto che i metodi maggiormente model based consentono di evitare più facilmente.

In realtà, tuttavia, la superiorità di TS rispetto a X11A non è conclusiva, una considerazione che si ritrova ripetuta in più parti del rapporto del progetto SARA. Non solo perché è difficile trovare metodi ottimali per il confronto di approcci diversi alla destagionalizzazione, ma anche perché sia X11A che TS producono serie idempotenti e perché i tests non sempre consentono di scegliere fra serie che hanno comportamenti similari ma differenze nelle strutture stocastiche.

Il passaggio da X11A a TS è stato netto e, in accordo alle raccomandazioni del progetto, si è anche costituito all'interno dell'Istat un gruppo di statistici che stabilmente mantiene i contatti con la comunità accademica e contribuisce ai lavori in tema di destagionalizzazione che hanno luogo nelle sedi europee. Nell'ambito del lavoro di produzione dei conti trimestrali italiani, i modelli di destagionalizzazione vengono di norma rivisti una volta l'anno, generalmente in occasione della stima del primo trimestre. Tuttavia, gli indicatori di maggiore impatto sulle variabili aggregate, come ad esempio gli indici della produzione industriale di alcune branche di attività economica, sono oggetto di particolare attenzione anche in corso d'anno. Gli strumenti grafici e diagnostici disponibili permettono di valutare molteplici aspetti della tenuta dei modelli di destagionalizzazione correntemente utilizzati, segnalandone eventuali aspetti critici (fallimento di uno o più test diagnostici, presenza di stagionalità residua, non significatività o instabilità dei parametri del modello ARIMA, scelta degli outliers, etc.) e fornendo le basi per guidare eventuali interventi correttivi. L'utilizzo in ambito Istat di strumenti condivisi, accompagnato dalla diffusione di un protocollo comune per la destagionalizzazione degli indicatori utilizzati per la stima dei conti trimestrali, ha consentito di raggiungere una maggiore uniformità nei criteri di scelta dei modelli e quindi una maggiore coerenza tra i dati prodotti dai diversi soggetti responsabili delle stime congiunturali.

3.3.2 I metodi di trimestralizzazione

Nel corso degli anni il metodo di Chow e Lin (CL) nella versione formulata dalla Banca d'Italia (CL-BdI) ha soddisfacentemente adempiuto al compito di consentire una disaggregazione temporale caratterizzata da elevato potere di lisciamento delle serie e di permettere accurate estrapolazioni in corso d'anno. Data l'esistenza di diversi altri metodi, l'Istat ha quindi ritenuto necessario di effettuare una verifica della bontà relativa dei principali metodi di trimestralizzazione, sempre al fine di mantenere l'Istituto al livello degli istituti centrali di statistica più avanzati. E' stata perciò istituita una Commissione a guida accademica alla quale hanno partecipato funzionari dell'Istat e utilizzatori con il compito di sperimentare i diversi metodi, ponendone a confronto proprietà e capacità di estrapolazione[22]. La selezione dei metodi si è

[22] I risultati del lavoro di questa Commissione sono descritti in Istat (2005).

naturalmente concentrata sui metodi ottimali, quelli cioè che sono riconducibili ad un problema di ottimizzazione vincolata: quello di minimizzare la somma dei quadrati degli scarti, calcolati alla frequenza bassa, fra le serie annuali e l'indicatore, o gli indicatori, di riferimento.

Le differenze fra i diversi metodi (si considerano qui quelli su cui ha più insistito la commissione) riguardano le proprietà statistiche di questi scarti. E' stato dimostrato che, in via del tutto generale essi seguono un processo stocastico del tipo Arima (p,d,q). I diversi metodi, però, fanno assunzioni diverse circa tale processo ipotizzando strutture stocastiche più complesse nel tentativo di distribuire sulle serie a frequenza elevata gli scarti aggregati fra le serie e gli indicatori nel modo più appropriato.

Il metodo CL suppone che gli scarti seguano un semplice processo AR(1). Il metodo di Fernandez, reinterpretando il metodo di Denton alla luce dei metodi ottimali, assume che tali scarti siano rappresentabili come un random walk. Infine, il metodo di Litterman ipotizza, come in Fernandez, uno schema random walk ma suppone anche che vi sia un'ulteriore componente di errore avente un comportamento AR(1). La sperimentazione ha considerato anche altri metodi, tra i quali il SUTSE, sui quali non ci intratterremo in questa sede rimandando per ulteriori informazioni al Rapporto finale della Commissione.

Ai fini di questa presentazione ci si concentra su due studi che sono rappresentativi dei risultati che sono confluiti nelle conclusioni della Commissione.

Un primo studio si pone due obiettivi. Il primo riguarda la stima dei parametri autoregressivi degli scarti della procedura CL effettuando stime che impiegano tre fra gli approcci maggiormente seguiti nella letteratura e estendendo l'esperimento ad altre metodologie (Fernandez, Litterman, Santos Silva e Cardoso e Di Fonzo). Il secondo si concentra sulla qualità delle estrapolazioni dei diversi metodi, sia in-sample, sia out-of-sample. Le conclusioni dello studio sono assai articolate: non ci si propone qui di riprodurle in dettaglio. Lo scopo è, invece, quello di richiamare alcuni punti che hanno portato l'Istat a modificare, in parte, le sue scelte operative in tema di trimestralizzazione.

Lo studio trova che il parametro autoregressivo del metodo CL-BdI (che minimizza la somma dei quadrati degli scarti (SSR) seguendo un procedimento di scanning del valore dal parametro autoregressivo) porta ad un numero di soluzioni non ammissibili maggiore di quello che si ha per gli altri metodi, in particolare di quello che si ottiene massimizzando la funzione di verosimiglianza. Considerando le sole soluzioni ammissibili, tuttavia, lo studio afferma che il metodo CL-BdI garantisce una buona affidabilità delle serie, ma, si afferma anche, che la procedura "non è teoricamente corretta perché il parametro [auto regressivo] è quasi sempre sovrastimato". Per quanto attiene poi alle simulazioni in-sample lo studio trova che il metodo di Fernandez produce i risultati più soddisfacenti, mentre, in quelle out-of-sample, le prestazioni di questo metodo sono intermedie. Infine, le simulazioni del metodo CL che massimizza la funzione di verosimiglianza sono migliori di quelle ottenute con gli altri metodi. Tali conclusioni hanno contribuito a formulare la raccomandazione, poi messa in pratica, di abbandonare la minimizzazione della SSR e di affiancare il metodo Fernàndez a quello CL .

In un altro studio, presentato alla Commissione, si valuta la capacità previsiva dei diversi metodi eseguendo simulazioni in avanti di quattro trimestri. Lo studio conclude che nessun metodo ha performances uniformemente migliori e che i metodi SUTSE, Fernandez e CL danno risultati comparabili.

La Commissione sulla scorta di tutti gli studi e, pur osservando che essi non sono conclusivi, ha raccomandato all'Istat una serie di appropriate iniziative come quella di procedere alla sperimentazione di metodi alternativi complessi che non sono operativamente attuabili nell'immediato. Sulle raccomandazioni di abbandonare il metodo CL-BdI (che minimizza la SSR) in favore della procedura CL basata sulla massimizzazione della funzione di verosimiglianza e di affiancare al metodo di CL quello di Fernàndez (per entrambe le procedure valutando l'opportunità di impiegare le versioni che consentono di utilizzare la trasformazione logaritmica delle serie), vale la pena di soffermarsi brevemente.

Per quanto riguarda la massimizzazione della funzione di verosimiglianza è noto che, nei piccoli campioni, i vantaggi di questo approccio sono limitati e che, inoltre, si possono produrre stime non affidabili quando gli indicatori hanno forti oscillazioni (una situazione questa non infrequente) o quando la stima del parametro regressivo ρ assume valori negativi.

Operativamente è stata adottata la strategia di utilizzare questo approccio quando il parametro è compreso tra 0 e 0,9. Laddove questa condizione non sia soddisfatta la strategia di stima dovrebbe fare ricorso all'uso di variabili di comodo e/o all'impiego del metodo di Fernàndez. Questo metodo utilizza nella stima le differenze prime delle variabili e impone a priori che il parametro autoregressivo ρ sia pari all'unità. Questa assunzione consente di semplificare notevolmente i calcoli, poiché elimina la stima del parametro autoregressivo dato che è sufficiente calcolare uno stimatore dei minimi quadrati generalizzati, con matrice di covarianza nota (a meno della varianza). Si può cioè mostrare (Lupi e Parigi (1994) che, data una stima preliminare, il problema di minimo è riconducibile a quello della procedura di Denton e che, inoltre, le formule del calcolo dei previsori vengono semplificate.

Ai fini della scelta del metodo di trimestralizzazione occorrerebbe, tuttavia, dedicare maggiore attenzione alla questione dell'esistenza di una relazione di lungo periodo fra la variabile annuale e l'indicatore o gli indicatori. Occorrerebbe verificare, cioè, se queste variabili siano cointegrate. Questa verifica, pur essendo consapevoli che i test di cointegrazione soffrono di limitazioni non trascurabili come nei casi in cui si impieghino serie storiche corte o quando vi siano interruzioni delle serie dovute a mutamenti del campo di osservazione o del grado di copertura, vale in generale qualsiasi sia il metodo di trimestralizzazione. La verifica dell'esistenza di cointegrazione vale, cioè sia che si utilizzi il metodo di CL (anche nelle versioni logaritmiche e/o dinamiche ora disponibili) o, per limitarci all'approccio suggerito dalla Commissione, quello di Fernàndez. La stima condotta sulle differenze prime delle variabili dovrebbe permettere di ottenere variabili stazionarie eliminando l'eventuale correlazione spuria che si ha quando esse siano solo apparentemente correlate perché evolvono nel tempo. Tale metodo è appropriato quando le serie siano integrate di ordine 1 perché permette di ottenere serie stazionarie ed un termine di errore anch'esso I(0). Ma le variabili economiche sono non infrequentemente caratterizzate da un ordine di integrazione maggiore di 1 come accade, per esempio, nel caso di taluni indici di prezzo, dei tassi d'interesse ecc. In questi casi la trasformazione delle variabili in differenze prime non assicura la loro stazionarietà e quella del termine di errore, il che dovrebbe portare a concludere che gli indicatori disponibili non sono adatti per la trimestralizzazione. In generale, allora, più che cercare di risolvere il problema dell'inadeguatezza degli indicatori attraverso l'impiego di sofisticate strutture stocastiche del termine di errore, occorrerebbe sostituire tali indicatori con altri che siano più rispettosi delle relazioni di equilibrio fra essi e la variabile a bassa frequenza. Per dirlo con altre parole il problema è quello della scelta degli indicatori: l'eventuale assenza di un punto comune di attrazione nel lungo periodo fra la variabile da trimestralizzare e gli indicatori non può essere elusa o aggirata dall'impiego di metodi di trimestralizzazioni complessi.

3.4 Le revisioni delle stime trimestrali del PIL: un confronto internazionale

A conclusione di questa breve rassegna degli sviluppi della CNT in Italia è opportuno fornire un'evidenza statistica circa la qualità della CNT italiana in rapporto a quella di altri paesi. A tal fine sono presentati alcuni indici sintetici che l'Istat pubblica di routine per i dati italiani[23]. In particolare si analizzano le differenze fra le variazioni tendenziali della prima stima (P) e quelle calcolate sulle serie pubblicate dopo 5 mesi (E5), dopo uno, due e tre anni (Y1,Y2 e Y3). L'analisi è estesa ai principali paesi (Francia, Germania Federale, Regno Unito, Spagna, Stati Uniti e Canada) e riprende lo studio inizialmente proposto in sede OCSE da Di Fonzo e successivamente aggiornato dall'OCSE stessa.

Dal confronto (Tavole 1-4) risulta che l'Ampiezza delle Revisioni dell'Italia (RMA), varia tra 0,11 e 0,33 ed è minore di quella degli altri paesi a raffronto ad eccezione della Spagna per i periodi di revisione (E5-P) e (Y1-P). Ad analoga conclusione si giunge se si considera la Revisione Quadratica Media e la Mediana delle revisioni. Il confronto è meno favorevole se si considera la Revisione Media Assoluta in termini relativi (RMAR) che tiene conto delle diversità nel tasso di crescita: i valori dell'indice per l'Italia sono superiori a quelli degli Stati Uniti, del Canada e della Spagna, una conclusione questa che riecheggia quella dello studio dell'OCSE al quale si è accennato in precedenza. L'indice tende ad essere tanto più elevato quanto minore è il tasso di crescita e questo sembra caratterizzare il caso italiano.

[23] Gli autori desiderano ringraziare la dott.ssa Maria Giovanna Piras per le elaborazioni effettuate e per le osservazioni al testo. I dati di base, compresi quelli dell'Italia, sono quelli resi disponibili dall'OCSE.

Tavola 1 - Revisioni delle variazioni tendenziali del Prodotto interno lordo - Dati destagionalizzati in volume

INDICATORI SINTETICI	ITALIA			
	E5-P	Y1-P	Y2-P	Y3-P
Periodo dal 1996.1 al:	2010.2	2009.3	2008.3	2007.3
Numero di osservazioni	58	55	51	47
AMPIEZZA MEDIA DELLE REVISIONI				
Revisione Media Assoluta (a)	0,11	0,19	0,23	0,33
Revisione media quadratica	0,15	0,23	0,30	0,42
Mediana delle revisioni in valore assoluto	0,08	0,17	0,19	0,31
Revisione Media Assoluta in termini Relativi (b)	0,08	0,13	0,19	0,26
Media della prima stima pubblicata in valore assoluto	1,46	1,46	1,20	1,27
DIREZIONE DELLE REVISIONI				
Revisione Media (c)	0,00	-0,02	0,02	0,18
Deviazione standard della Revisione Media	0,02	0,04	0,06	0,08
Statistica t di Student relativa alla Revisione Media (c)	-0,22	-0,57	0,36	2,38
Valori critici della distribuzione t di Student (0,1/0,05/0,01)	1.67/2/2.66	1.67/2/2.67	1.68/2.01/2.68	1.68/2.01/2.69
Significatività statistica della Revisione Media	NO	NO	NO	SI**
Mediana delle revisioni	0,00	-0,04	0,00	0,22
Indice di asimmetria delle revisioni	-0,03	0,08	0,05	-0,10
% di revisioni positive	46,55	43,64	50,98	68,09
% di revisioni negative	48,28	56,36	49,02	31,91
% di revisioni pari a zero	5,17	0,00	0,00	0,00
VARIABILITÀ DELLE REVISIONI				
Deviazione standard delle revisioni (d)	0,15	0,24	0,30	0,38
Revisione minima	-0,39	-0,63	-0,88	-0,66
Revisione massima	0,34	0,61	0,84	0,97
Campo di variazione delle revisioni	0,72	1,24	1,73	1,63
Intervallo in cui rientra il 90% delle revisioni	0,50	0,66	0,84	1,15
Scarto interquartile	0,14	0,33	0,35	0,50
IMPATTO DELLE REVISIONI SUL SEGNO DEI TASSI DI CRESCITA				
Concordanza di segno tra stima successiva e stima precedente	100,00	96,36	96,08	91,49
Misura di accelerazione per effetto delle revisioni	40,35	35,19	38,00	36,96
Misura di decelerazione per effetto delle revisioni	49,12	46,30	50,00	41,30

Legenda: P=Prima stima; E5=Stima dopo 5 mesi; Y1=stima dopo 1 anno; Y2=Stima dopo 2 anni; Y3=Stima dopo 3 anni
(a) RMA
(b) RMAR
(c) RM
(d) DSR

Tavola 2 - Revisioni delle variazioni tendenziali del Prodotto interno lordo - Dati destagionalizzati in volume

INDICATORI SINTETICI	GERMANIA				FRANCIA			
	E5-P	Y1-P	Y2-P	Y3-P	E5-P	Y1-P	Y2-P	Y3-P
Periodo dal 1996.1 al:	2010.2	2009.3	2008.3	2007.3	2010.2	2009.3	2008.3	2007.3
Numero di osservazioni	58	55	51	47	58	55	51	47
AMPIEZZA MEDIA DELLE REVISIONI								
Revisione Media Assoluta (a)	0,12	0,22	0,37	0,51	0,14	0,33	0,40	0,51
Revisione media quadratica	0,16	0,29	0,47	0,61	0,20	0,38	0,50	0,60
Mediana delle revisioni in valore assoluto	0,08	0,15	0,29	0,52	0,09	0,28	0,36	0,45
Revisione Media Assoluta in termini Relativi (b)	0,06	0,12	0,23	0,32	0,07	0,17	0,21	0,26
Media della prima stima pubblicata in valore assoluto	1,87	1,84	1,60	1,59	1,88	1,93	1,90	1,93
DIREZIONE DELLE REVISIONI								
Revisione Media (c)	0,02	0,04	-0,06	-0,11	-0,01	0,07	0,22	0,36
Deviazione standard della Revisione Media	0,03	0,05	0,09	0,13	0,03	0,07	0,09	0,09
Statistica t di Student relativa alla Revisione Media	0,91	0,71	-0,63	-0,86	-0,33	1,00	2,55	3,81
Valori critici della distribuzione t di Student (0,1/0,05/0,01)	1.67/2/2.66	1.67/2/2.67	1.68/2.01/2.68	1.68/2.01/2.69	1.67/2/2.66	1.67/2/2.67	1.68/2.01/2.68	1.68/2.01/2.69
Significatività statistica della Revisione Media	NO	NO	NO	NO	NO	NO	SI**	SI***
Mediana delle revisioni	0,00	0,04	-0,06	-0,05	0,01	0,13	0,24	0,41
Indice di asimmetria delle revisioni	0,15	-0,01	0,00	-0,11	-0,09	-0,15	-0,05	-0,11
% di revisioni positive	48,28	56,36	43,14	48,94	56,90	56,36	70,59	82,98
% di revisioni negative	41,38	43,64	56,86	51,06	41,38	43,64	29,41	17,02
% di revisioni pari a zero	10,34	0,00	0,00	0,00	1,72	0,00	0,00	0,00
VARIABILITÀ DELLE REVISIONI								
Deviazione standard delle revisioni (d)	0,16	0,29	0,47	0,61	0,20	0,38	0,45	0,48
Revisione minima	-0,46	-0,84	-1,06	-1,23	-0,67	-0,73	-0,75	-0,84
Revisione massima	0,43	0,75	0,90	1,04	0,52	0,77	1,29	1,43
Campo di variazione delle revisioni	0,90	1,59	1,96	2,27	1,19	1,50	2,03	2,27
Intervallo in cui rientra il 90% delle revisioni	0,50	0,95	1,55	1,88	0,62	1,10	1,54	1,65
Scarto interquartile	0,18	0,32	0,50	0,86	0,18	0,59	0,52	0,40
IMPATTO DELLE REVISIONI SUL SEGNO DEI TASSI DI CRESCITA								
Concordanza di segno tra stima successiva e stima precedente	98,28	100,00	98,04	93,62	100,00	98,18	94,12	95,74
Misura di accelerazione per effetto delle revisioni	49,12	46,30	42,00	39,13	42,11	38,89	40,00	43,48
Misura di decelerazione per effetto delle revisioni	45,61	46,30	46,00	39,13	47,37	50,00	46,00	43,48

Legenda: P=Prima stima; E5=Stima dopo 5 mesi; Y1=stima dopo 1 anno; Y2=Stima dopo 2 anni; Y3=Stima dopo 3 anni
(a) RMA
(b) RMAR
(c) RM
(d) DSR

Tavola 3 - Revisioni delle variazioni tendenziali del Prodotto interno lordo - Dati destagionalizzati in volume

INDICATORI	REGNO UNITO				SPAGNA			
SINTETICI	E5-P	Y1-P	Y2-P	Y3-P	E5-P	Y1-P	Y2-P	Y3-P
Periodo dal 1996.1 al:	2010.2	2009.4	2008.4	2007.3	2010_2	2009_3	2008_3	2007_3
Numero di osservazioni	58	56	52	47	58	55	51	47
AMPIEZZA MEDIA DELLE REVISIONI								
Revisione Media Assoluta (a)	0,24	0,26	0,28	0,39	0,07	0,19	0,37	0,50
Revisione media quadratica	0,31	0,34	0,36	0,49	0,11	0,25	0,45	0,63
Mediana delle revisioni in valore assoluto	0,18	0,19	0,21	0,34	0,03	0,17	0,30	0,35
Revisione Media Assoluta in termini Relativi (b)	0,10	0,10	0,12	0,16	0,02	0,06	0,12	0,16
Media della prima stima pubblicata in valore assoluto	2,45	2,50	2,35	2,41	2,97	3,05	3,05	3,13
DIREZIONE DELLE REVISIONI								
Revisione Media (c)	0,06	0,08	0,05	0,30	0,03	0,07	0,25	0,40
Deviazione standard della Revisione Media	0,04	0,05	0,07	0,08	0,01	0,04	0,07	0,10
Statistica t di Student relativa alla Revisione Media	1,39	1,48	0,76	3,63	2,01	1,63	3,38	4,13
Valori critici della distribuzione t di Student (0,1/0,05/0,01)	1.67/2/2.66	1.67/2/2.67	1.68/2.01/2.68	1.68/2.01/2.69	1.67/2/2.66	1.67/2/2.67	1.68/2.01/2.68	1.68/2.01/2.69
Significatività statistica della Revisione Media	NO	NO	NO	SI***	SI**	NO	SI***	SI***
Mediana delle revisioni	0,10	0,13	0,06	0,32	0,01	0,10	0,24	0,31
Indice di asimmetria delle revisioni	-0,15	-0,15	-0,03	-0,05	0,19	-0,12	0,02	0,20
% di revisioni positive	63,79	66,07	59,62	74,47	55,17	67,27	74,51	80,85
% di revisioni negative	36,21	33,93	40,38	25,53	31,03	32,73	25,49	19,15
% di revisioni pari a zero	0,00	0,00	0,00	0,00	13,79	0,00	0,00	0,00
VARIABILITÀ DELLE REVISIONI								
Deviazione standard delle revisioni (d)	0,31	0,33	0,36	0,39	0,11	0,24	0,37	0,49
Revisione minima	-1,00	-1,18	-0,98	-0,63	-0,27	-0,51	-0,59	-0,73
Revisione massima	0,80	0,85	1,08	1,24	0,47	0,81	1,16	1,79
Campo di variazione delle revisioni	1,79	2,04	2,06	1,86	0,74	1,32	1,75	2,51
Intervallo in cui rientra il 90% delle revisioni	0,88	0,85	1,03	1,25	0,37	0,81	1,16	1,41
Scarto interquartile	0,33	0,34	0,41	0,51	0,08	0,23	0,43	0,59
IMPATTO DELLE REVISIONI SUL SEGNO DEI TASSI DI CRESCITA								
Concordanza di segno tra stima successiva e stima precedente	100,00	100,00	98,08	100,00	100,00	100,00	100,00	100,00
Misura di accelerazione per effetto delle revisioni	43,86	49,09	45,10	47,83	47,37	48,15	34,00	34,78
Misura di decelerazione per effetto delle revisioni	38,60	40,00	37,25	30,43	38,60	33,33	32,00	28,26

Legenda: P=Prima stima; E5=Stima dopo 5 mesi; Y1=stima dopo 1 anno; Y2=Stima dopo 2 anni; Y3=Stima dopo 3 anni
(a) RMA
(b) RMAR
(c) RM
(d) DSR

Tavola 4 - Revisioni delle variazioni tendenziali del Prodotto interno lordo - Dati destagionalizzati in volume

INDICATORI	STATI UNITI				CANADA			
SINTETICI	E5-P	Y1-P	Y2-P	Y3-P	E5-P	Y1-P	Y2-P	Y3-P
Periodo dal 1996.1 al:	2010.2	2009.4	2008.4	2007.4	2010_2	2009_3	2008_3	2007_3
Numero di osservazioni	58	56	52	48	58	55	51	47
AMPIEZZA MEDIA DELLE REVISIONI								
Revisione Media Assoluta (a)	0,17	0,31	0,57	0,62	0,12	0,23	0,35	0,48
Revisione media quadratica	0,23	0,46	0,76	0,73	0,17	0,30	0,48	0,64
Mediana delle revisioni in valore assoluto	0,13	0,16	0,44	0,58	0,08	0,20	0,28	0,39
Revisione Media Assoluta in termini Relativi (b)	0,06	0,10	0,18	0,19	0,04	0,08	0,13	0,17
Media della prima stima pubblicata in valore assoluto	3,02	3,03	3,09	3,24	2,70	2,72	2,75	2,86
DIREZIONE DELLE REVISIONI								
Revisione Media (c)	0,01	-0,10	-0,28	-0,21	-0,01	0,07	0,23	0,34
Deviazione standard della Revisione Media	0,03	0,08	0,15	0,16	0,02	0,05	0,08	0,12
Statistica t di Student relativa alla Revisione Media	0,41	-1,34	-1,90	-1,32	-0,37	1,29	2,76	2,74
Valori critici della distribuzione t di Student (0,1/0,05/0,01)	1.67/2/2.66	1.67/2/2.67	1.68/2.01/2.68	1.68/2.01/2.68	1.67/2/2.66	1.67/2/2.67	1.68/2.01/2.68	1.68/2.01/2.69
Significatività statistica della Revisione Media	NO	NO	SI*	NO	NO	NO	SI***	SI***
Mediana delle revisioni	0,03	-0,01	-0,26	-0,40	0,00	0,05	0,20	0,20
Indice di asimmetria delle revisioni	-0,07	-0,21	-0,03	0,26	-0,05	0,05	0,07	0,26
% di revisioni positive	55,17	48,21	30,77	33,33	50,00	61,82	72,55	68,09
% di revisioni negative	44,83	51,79	69,23	66,67	43,10	38,18	27,45	31,91
% di revisioni pari a zero	0,00	0,00	0,00	0,00	6,90	0,00	0,00	0,00
VARIABILITÀ DELLE REVISIONI								
Deviazione standard delle revisioni (d)	0,23	0,45	0,71	0,70	0,17	0,30	0,42	0,54
Revisione minima	-0,68	-1,68	-2,58	-1,62	-0,52	-0,55	-0,51	-0,51
Revisione massima	0,58	0,72	1,31	1,31	0,56	1,03	1,58	1,74
Campo di variazione delle revisioni	1,26	2,40	3,89	2,92	1,08	1,57	2,09	2,25
Intervallo in cui rientra il 90% delle revisioni	0,66	1,38	2,24	2,34	0,52	0,99	1,43	1,81
Scarto interquartile	0,25	0,34	0,67	0,80	0,15	0,31	0,48	0,66
IMPATTO DELLE REVISIONI SUL SEGNO DEI TASSI DI CRESCITA								
Concordanza di segno tra stima successiva e stima precedente	100,00	98,21	92,31	100,00	100,00	100,00	100,00	100,00
Misura di accelerazione per effetto delle revisioni	38,60	34,55	35,29	36,17	49,12	42,59	46,00	47,83
Misura di decelerazione per effetto delle revisioni	47,37	47,27	47,06	42,55	42,11	46,30	44,00	39,13

Legenda: P=Prima stima; E5=Stima dopo 5 mesi; Y1=stima dopo 1 anno; Y2=Stima dopo 2 anni; Y3=Stima dopo 3 anni
(a) RMA
(b) RMAR
(c) RM
(d) DSR

Avendo riguardo alla Direzione delle Revisioni si osserva che la Revisione Media (RM) indica per il nostro paese che nelle revisioni non vi sono tendenze significative a sottostimare/sovrastimare la variazione del PIL (l'indice è positivo/negativo) fatta eccezione per il caso della revisione fatta a tre anni dalla prima (Y3-P) per la quale il test statistico segnala il caso di una revisione significativamente diversa da zero. Per gli altri paesi, esclusa la Germania dove le revisioni non sono mai significativamente diverse da zero, si riproduce una situazione simile a quella dell'Italia solo per il Regno Unito, mentre per Francia, Canada e Spagna si registra una tendenza della stima preliminare a sottostimare le stime pubblicate due e tre anni dopo. Negli Stati Uniti invece si registra una tendenza a sovrastimare la stima preliminare rispetto a quella pubblicata due anni dopo. Inoltre, non sono segnalate, per il nostro paese tendenze all'addensamento delle stime in una particolare direzione: infatti, l'indice di asimmetria (skewness), che è positivo (negativo) quando la mediana è minore (maggiore) della media, è molto vicino a zero e alle diverse date muta di segno. Nel caso degli altri paesi l'indice tende ad essere marginalmente più elevato e a presentare un'alternanza di segni, salvo i casi della Francia e del Regno Unito dove invece è segnalata una costante tendenza alla sovrastima.

Quanto, infine, alla Variabilità delle Revisioni i valori della Deviazione Standard delle Revisioni (DSR) dell'Italia sono inferiori a quelli degli altri paesi. Un'indicazione questa che è confermata dai dati che mostrano l'intervallo entro il quale ricade il 90% delle revisioni: a diverse date il dato italiano è minore di quello degli altri paesi.

Ad analoghe conclusioni si perviene se si considerano gli stessi indici costruiti, però, sulle variazioni congiunturali delle revisioni (Tavole 5-8).

Tavola 5 - Revisioni delle variazioni congiunturali del Prodotto interno lordo - Dati destagionalizzati in volume

INDICATORI SINTETICI	ITALIA			
	E5-P	Y1-P	Y2-P	Y3-P
Periodo dal 1995.2 al:	2010.2	2009.3	2008.3	2007.3
Numero di osservazioni	61	58	54	50
AMPIEZZA MEDIA DELLE REVISIONI				
Revisione Media Assoluta (a)	0,08	0,18	0,21	0,20
Revisione media quadratica	0,11	0,30	0,35	0,33
Mediana delle revisioni in valore assoluto	0,06	0,10	0,10	0,15
Revisione Media Assoluta in termini Relativi (b)	0,17	0,36	0,47	0,46
Media della prima stima pubblicata in valore ass	0,49	0,50	0,44	0,44
DIREZIONE DELLE REVISIONI				
Revisione Media (c)	0,00	-0,01	0,00	0,06
Deviazione standard della Revisione Media	0,02	0,03	0,03	0,03
Statistica t di Student relativa alla Revisione Media (c)	-0,11	-0,39	-0,10	1,64
Valori critici della distribuzione t di Student (0,1/0,05/0,01)	1.67/2/2.66	1.67/2/2.66	1.67/2.01/2.67	1.68/2.01/2.68
Significatività statistica della Revisione Media	NO	NO	NO	NO
Mediana delle revisioni	-0,01	-0,02	0,00	0,04
Indice di asimmetria delle revisioni	0,04	0,02	-0,01	0,04
% di revisioni positive	44,26	48,28	50,00	58,00
% di revisioni negative	50,82	51,72	50,00	42,00
% di revisioni pari a zero	4,92	0,00	0,00	0,00
VARIABILITÀ DELLE REVISIONI				
Deviazione standard delle revisioni (d)	0,12	0,30	0,36	0,33
Revisione minima	-0,32	-1,35	-1,54	-1,33
Revisione massima	0,30	1,22	1,30	1,30
Campo di variazione delle revisioni	0,62	2,56	2,83	2,63
Intervallo in cui rientra il 90% delle revisioni	0,36	0,69	0,92	0,65
Scarto interquartile	0,11	0,21	0,20	0,25
IMPATTO DELLE REVISIONI SUL SEGNO DEI TASSI DI CRESCITA				
Concordanza di segno tra stima successiva e stima precedente	95,08	87,93	94,44	92,00
Misura di accelerazione per effetto delle revisioni	48,33	45,61	41,51	42,86
Misura di decelerazione per effetto delle revisioni	46,67	47,37	45,28	36,73

Legenda: P=Prima stima; E5=Stima dopo 5 mesi; Y1=stima dopo 1 anno; Y2=Stima dopo 2 anni; Y3=Stima dopo 3 anni

(a) RMA

(b) RMAR

(c) RM

(d) DSR

Tavola 6 - Revisioni delle variazioni congiunturali del Prodotto interno lordo - Dati destagionalizzati in volume

INDICATORI SINTETICI	GERMANIA				FRANCIA			
	E5-P	Y1-P	Y2-P	Y3-P	E5-P	Y1-P	Y2-P	Y3-P
Periodo dal 1995.2 al:	2010.2	2009.3	2008.3	2007.3	2010.2	2009.3	2008.3	2007.3
Numero di osservazioni	61	58	54	50	61	58	54	50
				AMPIEZZA MEDIA DELLE REVISIONI				
Revisione Media Assoluta (a)	0,09	0,16	0,25	0,33	0,09	0,14	0,18	0,22
Revisione media quadratica	0,14	0,21	0,31	0,39	0,12	0,19	0,22	0,28
Mediana delle revisioni in valore assoluto	0,06	0,12	0,19	0,30	0,07	0,11	0,14	0,19
Revisione Media Assoluta in termini Relativi (b)	0,16	0,29	0,52	0,72	0,18	0,27	0,34	0,42
Media della prima stima pubblicata in valore assoluto	0,57	0,56	0,47	0,46	0,53	0,53	0,52	0,53
				DIREZIONE DELLE REVISIONI				
Revisione Media (c)	0,03	0,01	0,01	-0,02	-0,03	-0,02	0,02	0,07
Deviazione standard della Revisione Media	0,02	0,03	0,04	0,05	0,01	0,03	0,03	0,03
Statistica t di Student relativa alla Revisione Media	1,48	0,52	0,22	-0,32	-1,77	-0,83	0,54	2,10
Valori critici della distribuzione t di Student (0,1/0,05/0,01)	1.67/2/2.66	1.67/2/2.66	1.67/2.01/2.67	1.68/2.01/2.68	1.67/2/2.66	1.67/2/2.66	1.67/2.01/2.67	1.68/2.01/2.68
Significatività statistica della Revisione Media	NO	NO	NO	NO	SI*	NO	NO	SI**
Mediana delle revisioni	0,00	0,01	0,03	-0,05	-0,02	-0,03	0,01	0,04
Indice di asimmetria delle revisioni	0,20	0,04	-0,05	0,09	-0,06	0,01	0,05	0,11
% di revisioni positive	45,90	51,72	57,41	46,00	40,98	43,10	51,85	60,00
% di revisioni negative	40,98	48,28	42,59	54,00	57,38	56,90	48,15	40,00
% di revisioni pari a zero	13,11	0,00	0,00	0,00	1,64	0,00	0,00	0,00
				VARIABILITÀ DELLE REVISIONI				
Deviazione standard delle revisioni (d)	0,14	0,21	0,31	0,39	0,12	0,19	0,23	0,28
Revisione minima	-0,29	-0,56	-0,60	-0,69	-0,30	-0,53	-0,49	-0,58
Revisione massima	0,49	0,48	0,59	0,74	0,22	0,63	0,67	0,66
Campo di variazione delle revisioni	0,78	1,04	1,19	1,43	0,51	1,16	1,16	1,24
Intervallo in cui rientra il 90% delle revisioni	0,47	0,68	1,03	1,25	0,41	0,52	0,75	0,92
Scarto interquartile	0,13	0,24	0,36	0,58	0,12	0,23	0,28	0,35
				IMPATTO DELLE REVISIONI SUL SEGNO DEI TASSI DI CRESCITA				
Concordanza di segno tra stima successiva e stima precedente	98,36	94,83	85,19	82,00	96,72	93,10	92,59	92,00
Misura di accelerazione per effetto delle revisioni	40,00	40,35	35,85	32,65	45,00	40,35	39,62	38,78
Misura di decelerazione per effetto delle revisioni	50,00	47,37	37,74	36,73	46,67	42,11	35,85	32,65

Legenda: P=Prima stima; E5=Stima dopo 5 mesi; Y1=stima dopo 1 anno; Y2=Stima dopo 2 anni; Y3=Stima dopo 3 anni
(a) RMA
(b) RMAR
(c) RM
(d) DSR

Tavola 7 - Revisioni delle variazioni congiunturali del Prodotto interno lordo - Dati destagionalizzati in volume

INDICATORI	REGNO UNITO				SPAGNA			
SINTETICI	E5-P	Y1-P	Y2-P	Y3-P	E5-P	Y1-P	Y2-P	Y3-P
Periodo dal 1995.2 al	2010.2	2009.4	2008.4	2007.4	2010.2	2009.3	2008.3	2007.3
Numero di osservazioni	61	59	55	50	61	58	54	50
AMPIEZZA MEDIA DELLE REVISIONI								
Revisione Media Assoluta (a)	0,13	0,16	0,18	0,18	0,09	0,12	0,18	0,24
Revisione media quadratica	0,16	0,21	0,22	0,23	0,17	0,17	0,23	0,32
Mediana delle revisioni in valore assoluto	0,10	0,13	0,14	0,14	0,05	0,10	0,15	0,18
Revisione Media Assoluta in termini Relativi (b)	0,22	0,27	0,31	0,31	0,13	0,16	0,24	0,31
Media della prima stima pubblicata in valore assoluto	0,59	0,59	0,57	0,57	0,72	0,75	0,73	0,76
DIREZIONE DELLE REVISIONI								
Revisione Media (c)	0,03	0,03	0,02	0,07	0,01	0,01	0,02	0,10
Deviazione standard della Revisione Media	0,02	0,03	0,03	0,03	0,02	0,02	0,03	0,05
Statistica t di Student relativa alla Revisione Media	1,51	1,02	0,48	2,24	0,69	0,39	0,68	2,04
Valori critici della distribuzione t di Student (0,1/0,05/0,01)	1.67/2/2.66	1.67/2/2.66	1.67/2/2.67	1.68/2.01/2.68	1.67/2/2.66	1.67/2/2.66	1.67/2.01/2.67	1.68/2.01/2.68
Significatività statistica della Revisione Media	NO	NO	NO	SI**	NO	NO	NO	SI**
Mediana delle revisioni	0,05	0,03	0,01	0,06	0,00	0,01	0,04	0,05
Indice di asimmetria delle revisioni	-0,09	-0,01	0,03	0,06	0,09	0,02	-0,05	0,16
% di revisioni positive	60,66	62,71	50,91	62,00	49,18	51,72	57,41	56,00
% di revisioni negative	39,34	37,29	49,09	38,00	39,34	48,28	42,59	44,00
% di revisioni pari a zero	0,00	0,00	0,00	0,00	11,48	0,00	0,00	0,00
VARIABILITÀ DELLE REVISIONI								
Deviazione standard delle revisioni (d)	0,16	0,21	0,23	0,22	0,17	0,17	0,23	0,31
Revisione minima	-0,50	-0,71	-0,58	-0,39	-0,34	-0,34	-0,55	-0,48
Revisione massima	0,38	0,51	0,43	0,64	0,71	0,76	0,67	1,07
Campo di variazione delle revisioni	0,88	1,21	1,01	1,03	1,05	1,09	1,22	1,55
Intervallo in cui rientra il 90% delle revisioni	0,46	0,64	0,73	0,73	0,55	0,49	0,72	0,88
Scarto interquartile	0,19	0,25	0,30	0,25	0,09	0,19	0,27	0,41
IMPATTO DELLE REVISIONI SUL SEGNO DEI TASSI DI CRESCITA								
Concordanza di segno tra stima successiva e stima precedente	98,36	96,61	96,36	98,00	100,00	98,28	98,15	100,00
Misura di accelerazione per effetto delle revisioni	36,67	34,48	31,48	34,69	40,00	35,09	37,74	30,61
Misura di decelerazione per effetto delle revisioni	43,33	39,66	37,04	40,82	36,67	33,33	37,74	30,61

Legenda: P=Prima stima; E5=Stima dopo 5 mesi; Y1=stima dopo 1 anno; Y2=Stima dopo 2 anni; Y3=Stima dopo 3 anni
(a) RMA
(b) RMAR
(c) RM
(d) DSR

Tavola 8 - Revisioni delle variazioni congiunturali del Prodotto interno lordo - Dati destagionalizzati in volume

INDICATORI SINTETICI	STATI UNITI E5-P	STATI UNITI Y1-P	STATI UNITI Y2-P	STATI UNITI Y3-P	CANADA E5-P	CANADA Y1-P	CANADA Y2-P	CANADA Y3-P
Periodo dal 1995.2 al	2010.2	2009.4	2008.4	2007.4	2010.2	2009.3	2008.3	2007.3
Numero di osservazioni	61	59	55	51	61	58	54	50
AMPIEZZA MEDIA DELLE REVISIONI								
Revisione Media Assoluta (a)	0,15	0,18	0,26	0,25	0,07	0,12	0,18	0,21
Revisione media quadratica	0,18	0,24	0,34	0,32	0,09	0,18	0,22	0,25
Mediana delle revisioni in valore assoluto	0,12	0,16	0,23	0,20	0,06	0,10	0,15	0,17
Revisione Media Assoluta in termini Relativi (b)	0,19	0,24	0,35	0,33	0,10	0,18	0,27	0,29
Media della prima stima pubblicata in valore assoluto	0,75	0,76	0,74	0,76	0,69	0,67	0,67	0,71
DIREZIONE DELLE REVISIONI								
Revisione Media (c)	0,01	0,01	-0,06	-0,02	0,01	-0,02	0,04	0,07
Deviazione standard della Revisione Media	0,02	0,03	0,05	0,04	0,01	0,02	0,03	0,04
Statistica t di Student relativa alla Revisione Media	0,64	0,33	-1,26	-0,48	1,12	-0,75	1,34	1,84
Valori critici della distribuzione t di Student (0,1/0,05/0,01)	1.67/2/2.66	1.67/2/2.66	1.67/2/2.67	1.68/2.01/2.68	1.67/2/2.66	1.67/2/2.66	1.67/2.01/2.67	1.68/2.01/2.68
Significatività statistica della Revisione Media	NO	NO	NO	NO	NO	NO	NO	SI*
Mediana delle revisioni	0,03	0,04	-0,04	-0,03	0,01	0,01	0,04	0,09
Indice di asimmetria delle revisioni	-0,08	-0,14	-0,07	0,02	0,04	-0,14	-0,01	-0,06
% di revisioni positive	52,46	59,32	45,45	43,14	55,74	56,90	55,56	64,00
% di revisioni negative	47,54	40,68	54,55	56,86	37,70	43,10	44,44	36,00
% di revisioni pari a zero	0,00	0,00	0,00	0,00	6,56	0,00	0,00	0,00
VARIABILITÀ DELLE REVISIONI								
Deviazione standard delle revisioni (d)	0,18	0,24	0,34	0,32	0,09	0,18	0,22	0,25
Revisione minima	-0,66	-0,61	-0,95	-0,69	-0,21	-0,72	-0,46	-0,41
Revisione massima	0,35	0,62	0,63	0,90	0,24	0,43	0,51	0,69
Campo di variazione delle revisioni	1,01	1,24	1,58	1,59	0,45	1,15	0,96	1,10
Intervallo in cui rientra il 90% delle revisioni	0,53	0,77	1,11	1,05	0,26	0,45	0,67	0,74
Scarto interquartile	0,23	0,30	0,37	0,42	0,11	0,18	0,30	0,31
IMPATTO DELLE REVISIONI SUL SEGNO DEI TASSI DI CRESCITA								
Concordanza di segno tra stima successiva e stima precedente	100,00	98,31	94,55	96,08	98,36	98,28	96,30	98,00
Misura di accelerazione per effetto delle revisioni	46,67	44,83	38,89	40,00	43,33	40,35	35,85	32,65
Misura di decelerazione per effetto delle revisioni	45,00	39,66	40,74	36,00	50,00	45,61	37,74	36,73

Legenda: P=Prima stima; E5=Stima dopo 5 mesi; Y1=stima dopo 1 anno; Y2=Stima dopo 2 anni; Y3=Stima dopo 3 anni
(a) RMA
(b) RMAR
(c) RM
(d) DSR

La Revisione Media (RM) dell'Italia è, insieme a quelle della Francia, del Regno Unito, e del Canada, più bassa di quella degli altri paesi europei e degli Stati Uniti, anche se va osservato che le differenze fra paesi sono assai contenute.

Avendo riguardo alla Revisione Media in Termini Relativi (RMAR), si osserva che i valori più elevati dell'indice si riscontrano per l'Italia (come nel caso delle variazioni a un anno data) ma anche per la Germania per la Francia. Questo risultato, se per l'Italia confermerebbe la conclusione precedentemente avanzata dall'OCSE che vi è una correlazione negativa fra dimensione delle revisioni e crescita, potrebbe essere revocato in dubbio osservando che nel caso della Spagna e del Regno Unito, paesi che per gran parte del periodo sono cresciuti velocemente, gli indici son relativamente contenuti.

Per quanto attiene alla Direzione delle Revisioni i valori della RM sono tutti molto contenuti anche se si può notare qualche differenza fra paesi. La revisione è significativamente diversa da zero per la Francia (nel caso delle revisioni a 5 mesi e a tre anni) e per il Regno Unito, Spagna e Canada (per le revisioni effettuate a tre anni dalla prima stima).

Per tutti i paesi, poi, non si evidenziano addensamenti significativi delle revisioni sui valori più elevati o su quelli più bassi.

Infine per quanto attiene alla Variabilità delle Revisioni si osserva che il Campo di Variazione delle Revisioni dell'Italia è sensibilmente maggiore di quello di tutti gli altri paesi a causa della presenza di qualche valore anomalo delle revisioni. A mitigare questa conclusione non favorevole all'Italia sta però la considerazione che lo Scarto Interquartile (calcolato come la differenza tra il 3° e il 1° quartile, che meno risente della presenza di valori anomali isolati, è, nel caso dell'Italia, il più basso fra quelli dei paesi a raffronto.

La sintetica disamina di questi dati porta a concludere che la CNT italiana ha caratteristiche di affidabilità simili o migliori di quella di altri paesi.

4. Il contesto internazionale, i nodi ancora irrisolti e le prospettive future

4.1 L'importanza e l'utilizzo della contabilità nazionale in sede internazionale

Nella prima parte degli anni '90 si è assistito ad un progressivo intensificarsi delle attività di armonizzazione e monitoraggio delle stime prodotte dagli stati membri da parte dell'Eurostat, l'ufficio statistico dell'unione europea. Diversamente da quello che era avvenuto in occasione dell'adozione del SEC70 e del SEC79, l'applicazione del SEC95 è stata disciplinata da un regolamento del Consiglio (Reg. CE 2223/96, poi successivamente più volte emendato), che ha imposto agli stati membri l'obbligo di adeguarsi alle definizioni e agli schemi classificatori contenuti nell'allegato A dello stesso regolamento[24], e di rispettare nei tempi e nei contenuti un dettagliato programma di trasmissione dei dati (allegato B), fissando al 30 aprile del 1999 per tutti i paesi la data di introduzione del nuovo sistema.

In sede comunitaria è aumentato il ricorso agli aggregati di contabilità nazionale come indicatori utilizzati per orientare le politiche, e per fini amministrativi, come testimonia il fatto che il PIL pro capite regionale costituisce un parametro di

[24] Eurostat (1996).

riferimento per la ripartizione dei fondi strutturali e che il prodotto nazionale lordo (con il SEC95 il reddito nazionale lordo - GNI) è assunto ormai da tempo come indicatore della capacità contributiva degli Stati membri e sulla sua base viene calcolata la "quarta risorsa", la più importante fonte di finanziamento del bilancio comunitario. Il vaglio che i conti dell'Italia subiscono da parte delle istituzioni dell'Unione europea sulla base di numerosi atti giuridici, riguarda proprio la capacità del Paese di fornire delle stime che, per potere essere utilizzate nei processi decisionali e a fini amministrativi, devono rispondere ai requisiti dell'affidabilità, dell'esaustività, della coerenza con gli schemi contabili vigenti, e della effettiva confrontabilità internazionale. L'attività di armonizzazione in sede Eurostat è andata progressivamente crescendo nel tempo: oltre a quella, ormai ventennale, di validazione delle stime sul Prodotto nazionale lordo, bisogna citare l'azione di monitoraggio che viene effettuata su tutti gli aggregati dei conti annuali e sulle stime trimestrali, di cui viene valutata sia l'affidabilità che la tempestività. Una trattazione a parte, che non può essere fatta in questa sede, meriterebbe l'analisi del processo di monitoraggio dei conti pubblici nell'ambito del Patto di stabilità e crescita, il cui ultimo atto è rappresentato dalla Comunicazione della Commissione del marzo di quest'anno sul rafforzamento dei poteri di controllo della Commissione sui dati di finanza pubblica dei paesi membri dell'Ue.

Attualmente sono quattordici i regolamenti che hanno per oggetto dati di contabilità nazionale, oltre al regolamento SEC95: va ricordato in particolare che è stata resa obbligatoria ormai da alcuni anni anche la trasmissione di dati trimestrali dei conti delle società non finanziarie, delle famiglie[25] e delle amministrazioni pubbliche. Nel futuro gli obblighi regolamentari saranno ancora più estesi: sta per essere approvato il primo dei regolamenti previsti sui conti ambientali ed è cominciata in Consiglio (dopo essere stata già svolta in sede tecnica) la discussione del regolamento con il quale verrà adottato il SEC2010, versione adattata per l'Europa dello SNA 2008. Anche nell'ambito della procedura in via di costruzione sulla prevenzione e correzione degli squilibri macroeconomici (Proposta di regolamento del Parlamento e europeo e del Consiglio "*on the prevention and correction of macroeconomic imbalances*" e proposta di regolamento del Parlamento e europeo e del Consiglio "*on enforcement measures to correct excessive imbalances in the euro area*") si fa riferimento a informazioni costruite sulla base dei conti nazionali (oltre, naturalmente, ai dati di finanza pubblica, sono stati selezionati indicatori di bilancia dei pagamenti coerenti con il conto delle transazioni internazionali e indicatori di *unit labour cost* elaborati nel quadro dei conti nazionali).

4. 2 I dati di base

Riguardo all'adeguatezza dei dati di base, nonostante gli sviluppi degli ultimi anni, ci sono alcuni aspetti critici che devono essere sottolineati, e che è bene tenere presenti alla vigilia della revisione generale prevista per la fine di quest'anno per il passaggio

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[25] Per quanto riguarda i conti delle società non finanziarie e delle famiglie, andando oltre le richieste dei regolamenti comunitari, vengono fornite anche le stime depurate dalla componente stagionale.

alla Nace Rev.2 e in prospettiva per la futura implementazione del SEC2010, che sarà realizzata nel 2014.

La contabilità nazionale utilizza direttamente i microdati rilevati attraverso le indagini sulle famiglie e sulle imprese, che vengono successivamente sottoposti ad analisi, elaborazioni ed integrazioni per giungere alla stima delle variabili economiche e del numero di addetti e dipendenti. L'esigenza di un diverso trattamento dei dati rispetto alle tradizionali procedure utilizzate dai curatori delle indagini scaturisce da diversi motivi: la necessità di effettuare stime per domini differenti, generalmente più fini, di quelli previsti dalle indagini; l'utilizzo di un insieme molto ampio di variabili, costituito da molte voci presenti nelle sezioni secondarie dei questionari, necessarie per il passaggio dalle definizioni di contabilità nazionale. La più ampia disponibilità di informazioni sulle imprese, sia a livello strutturale che congiunturale, dovuta anche agli obblighi imposti dai regolamenti comunitari (regolamento SBS sulle statistiche strutturali delle imprese regolamento STS sulle statistiche congiunturali), costituisce un indubbio miglioramento rispetto al passato, ma la coerenza tra i dati micro e le stime di contabilità nazionale continua ad essere molto difficile da conservare. Rimane inoltre una grave carenza di informazione a livello infrannuale sulla variazione delle scorte.

Le indagini *ad hoc* presso le imprese tradizionalmente orientate alle esigenze specifiche dei conti nazionali, come ad esempio l'indagine sulla struttura dei costi, vengono ormai percepite come troppo onerose per i rispondenti. Per ridurre il carico statistico sulle imprese si tende pertanto ad aumentare l'utilizzo dei dati amministrativi (bilanci civilistici, studi di settore, dati degli archivi INPS): spesso però questo comporta una perdita di informazioni importanti per garantire una corretta rappresentazione della complessità del funzionamento del sistema economico italiano, già particolarmente difficile da misurare a causa della forte presenza di microimprese.

Nonostante il progressivo adeguamento delle classificazioni delle attività economiche (dalla Nace-Clio alla Nace Rev.1 e prossimamente alla Nace Rev.2) alle trasformazioni del sistema economico, le difficoltà di rappresentazione del processo produttivo secondo lo schema della *supply* che individua sia le produzioni tipiche che quelle secondarie delle branche di attività economica non sono diminuite: nell'ambito dell'impresa è sempre più difficile identificare correttamente le unità di attività economica e, nell'ambito di queste ultime, individuare in maniera esaustiva le diverse produzioni secondarie. L'internazionalizzazione delle unità produttive rende poi sempre più ardua la misurazione dei risultati economici realizzati all'interno del paese.

Un altro problema complesso è rappresentato dalle stime in volume dei flussi degli scambi con l'estero. La carenza (fino a pochi anni fa) di indicatori dei prezzi praticati dalle imprese esportatrici e la mancanza (ancora oggi) di analoghi indicatori per le importazioni, ha costretto i contabili nazionali a continuare ad utilizzare i valori medi unitari come base per le loro elaborazioni; ciò ha portato negli anni più recenti ad una sottostima della dinamica dei flussi reali degli scambi, che si è concentrata soprattutto sull'evoluzione della componente estera della domanda[26]: su questo tema si sta svolgendo un approfondimento che potrebbe portare a rivedere i dati attualmente pubblicati in occasione della prossima revisione generale. Più in generale, si può

[26] Un'analisi di questo problema è contenuta in Bugamelli M. (2007).

constatare come il sistema di indicatori di prezzo auspicato da sir Claus Moser non sia stato pienamente realizzato, non tanto per la componente internazionale, quanto soprattutto per la parte che riguarda i servizi alle imprese, anche se in questi ultimi anni sono stati registrati alcuni progressi: sono stati, infatti, pubblicati alcuni nuovi indicatori di prezzo dei servizi (comunicazioni) e si sta lavorando su quelli del settore dei trasporti.

Per quanto riguarda le fonti sulle famiglie, si è assistito ad una evoluzione del loro utilizzo nei conti nazionali: mentre l'indagine sulle forze di lavoro resta la fonte principale per la stima dell'offerta di lavoro, la rilevazione sui consumi ha perso importanza per la stima della spesa delle famiglie (anche a seguito di una approfondita analisi, promossa dalla Ue, che ne ha evidenziato i limiti ai fini del suo impiego nella costruzione degli aggregati dei conti nazionali), ed è stata sostituita in molti casi dal calcolo della disponibilità interna dei beni di consumo, con la conseguenza di una diminuzione del grado di indipendenza tra i due approcci della spesa e della formazione del prodotto.

4. 3 I nuovi prodotti

Nell'ultimo decennio l'Istat, andando anche oltre le richieste della normativa europea, ha ampliato la disponibilità di indicatori derivanti dai conti nazionali: si citano in particolare gli indicatori di produttività totale dei fattori, le stime del valore aggiunto provinciale e per sistema locale del lavoro, la stima del reddito disponibile del settore delle famiglie distintamente per i segmenti delle famiglie produttrici e consumatrici, le stime del settore delle istituzioni sociali private al servizio delle famiglie.

Il completamento degli schemi contabili non è ancora compiuto, ma sono in corso varie azioni in questa direzione, come testimoniano i seguenti esempi: la quantificazione dell'economia illegale, che dovrà integrare le stime del PIL, è stata avviata con riguardo, in questa prima fase, al traffico e al consumo di droghe; il raccordo tra conti economici e conti finanziari e l'esame delle discrepanze sono ormai regolarmente effettuati per il settore delle amministrazioni pubbliche; il progetto di sviluppo dei conti patrimoniali ha già prodotto una stima provvisoria sulle abitazioni e del terreno sottostante, di altri assets non finanziari e dello stock di beni di consumo durevoli.

Il rapporto Stiglitz ha mostrato l'inadeguatezza di un sistema di misurazione incentrato solo sul Pil, ma ha anche messo in evidenza che nell'ambito dei conti nazionali allargati a quelli satellite si possono trovare indicatori molto informativi, come il reddito disponibile aggiustato per tenere conto dei trasferimenti sociali in natura, accompagnato da informazioni sulla sua distribuzione, i dati sulla ricchezza finanziaria e non finanziaria delle famiglie, ed alcuni indicatori tratti dalla contabilità ambientale. La *Task Force on Household Perspective* recentemente costituita dall'Eurostat ha fornito una serie di raccomandazioni proprio su questi temi: in particolare è stato dato un forte impulso, attraverso un'iniziativa congiunta Eurostat-Ocse, alla costruzione di indicatori della distribuzione del reddito disponibile delle famiglie, attraverso il collegamento tra i dati macro della conti per settore istituzionale e i dati micro delle indagini presso le famiglie.

5 Considerazioni conclusive

La revisione del 1987 e la nascita del nuovo sistema dei conti trimestrali si confermano ancora oggi un momento fondamentale per la contabilità nazionale italiana. L'attenzione che negli anni '80 è stata dedicata al PIL (annuale e trimestrale) e alle tavole I-O, e l'opera di armonizzazione a livello internazionale che si è concentrata proprio sul PNL, hanno forse inizialmente fatto passare in secondo piano i temi legati al completamento del sistema dei conti, rallentandone lo sviluppo. Nei due decenni successivi, le esigenze di monitoraggio dei conti pubblici, i nuovi obblighi regolamentari e, più recentemente, le raccomandazioni del rapporto Stiglitz hanno ampliato sensibilmente la domanda di informazioni rivolta ai contabili nazionali: al centro dello sviluppo futuro delle statistiche della contabilità nazionale vi sono ora temi quali i conti delle famiglie, il raccordo tra conti reali e conti finanziari, la coerenza tra stock e flussi. Va tuttavia tenuto presente che i livelli di qualità raggiunti nella parte di produzione più "matura" dei dati di contabilità nazionale, cioè proprio quella che ha le sue fondamenta nel lavoro avviato negli anni '80, non sono un dato acquisito una volta per tutte, ma devono essere mantenuti in un contesto di sempre maggiore difficoltà di misurazione delle variabili, di progressiva sostituzione dei dati di indagine con dati amministrativi, di riduzione delle risorse assegnate agli istituti di statistica. E questa è una sfida forse meno ricca di attrattiva per i contabili nazionali rispetto all'ampliamento dell'offerta di informazioni, ma altrettanto importante.

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Computational aspects in orthogonal fractional factorial design generation

Roberto Fontana

Abstract Generation of orthogonal fractional factorial designs (OFFDs) is an important and extensively studied subject in applied statistics. In this paper we analyse computational methods that originate by the joint use of polynomial counting functions and algebraic *strata*.

Key words: Algebraic Statistics, Design of Experiments, Hilbert Basis, Markov Basis, Integer Linear Programming

1 Introduction

In Section 2 we briefly review the algebraic theory of orthogonal fractional factorial designs, OFFDs, based on polynomial counting functions and *strata*. In Section 3 we present some applications including the set up of an optimization problem whose solutions are minimum sized OFFDs. Finally, concluding remarks are given in Section 4.

2 Algebraic description of fractional factorial designs

We report a very short summary of the algebraic description of fractional factorial designs based on *strata*. The main reference for this summary is [4]. The interested reader can find further information in [6], [7] and [5].

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Let us consider an experiment which includes m factors $\mathscr{D}_j,\ j=1,\ldots,m$. Let us code the n_j levels of the factor $\mathscr{D}_j$ with the n_j-th roots of the unity $\mathscr{D}_j = \{\omega_0^{(n_j)},\ldots,\omega_{n_j-1}^{(n_j)}\}$ where $\omega_k^{(n_j)} = \exp\left(\sqrt{-1}\,\frac{2\pi}{n_j}\,k\right)$, $k=0,\ldots,n_j-1$ $j=1\ldots,m$.

The *full factorial design* with *complex coding* is $\mathscr{D} = \mathscr{D}_1 \times \cdots \mathscr{D}_j \cdots \times \mathscr{D}_m$. We denote its cardinality by $\#\mathscr{D}$, $\#\mathscr{D} = \prod_{j=1}^{m} n_j$.

We define a fraction $\mathscr{F}$ as a multiset $(\mathscr{F}_*, f_*)$ whose underlying set of elements $\mathscr{F}_*$ is contained in $\mathscr{D}$ and f_* is the multiplicity function $f_* : \mathscr{F}_* \to \mathbb{N}$ that for each element in $\mathscr{F}_*$ gives the number of times it belongs to the multiset $\mathscr{F}$. We define the *counting function* of $\mathscr{F}$ as the function equal to f_* over the underlying set $\mathscr{F}_*$ and equal to zero otherwise. We denote the counting function of $\mathscr{F}$ by R. The *counting vector* Y is the column vector that contains the values of the counting function R for all the points ζ of $\mathscr{D}$, $Y = (y_\zeta)$ with $y_\zeta = R(\zeta), \zeta \in \mathscr{D}$ and $y_\zeta \in \mathbb{N}$. The number of rows of Y is $\#\mathscr{D}$. An *indicator function* of a fraction is a counting function that can only take the values 0 and 1 over $\mathscr{D}$.

We now define projectivity and, in particular, its relation with orthogonal arrays.

Definition 1. A fraction $\mathscr{F}$ *factorially projects* onto the I-factors, $I \subset \{1,\ldots,m\}$, if the projection is a multiple full factorial design, i.e. a full factorial design where each point appears equally often.

Definition 2. A fraction $\mathscr{F}$ is a *mixed orthogonal array* of strength t if it factorially projects onto any I-factors with $\#I = t$.

The joint use of *polynomial counting functions* and *strata*, [4], allows us to obtain the following Proposition 1.

Proposition 1. *A fraction $\mathscr{F}$* factorially projects *onto the I-factors, $I \subset \{1,\ldots,m\}$, if, and only if, $A_I Y = 0$ where A_I is a certain integer matrix (see [4] for its definition) and Y is the counting vector of $\mathscr{F}$.*

Corollary 1. *A fraction $\mathscr{F}$* factorially projects *onto the $I_1, I_2, \ldots, I_k$ factors, $I_1,\ldots,I_k \subset \{1,\ldots,m\}$, $k>0$, if, and only if, $A_{I_1\ldots I_k} Y = 0$ where $A_{I_1\ldots I_k} = \begin{bmatrix} A_{I_1} \\ \ldots \\ A_{I_k} \end{bmatrix}$, A_{I_j} is defined as in Proposition 1, $j=1,\ldots,k$, and Y is the counting vector of $\mathscr{F}$.*

Proposition 1 and Corollary 1 make it possible to express orthogonality conditions for any mixed level fractional factorial design as integer linear combinations of the values $R(\zeta) \equiv y_\zeta$ that must equal zero. In Section 3, we will show the use of this property to generate fractional factorial designs.

3 Generation of fractions

We use Proposition 1 and Corollary 1 to generate fractions that satisfy a given set of projectivity constraints. Formally, we give the following definition:

Definition 3. Given $\mathscr{C} = \{I_1, \ldots, I_k\}$ with $I_j \subset \{1, \ldots, m\}$, $k > 0$ a counting vector Y associated to $\mathscr{F}$ is a $\mathscr{C}$-compatible counting vector if $A_{\mathscr{C}} Y = 0$ where $A_{\mathscr{C}}$ is defined as in Corollary 1.

The set of all the fractions of $\mathscr{D}$ whose counting vectors, or equivalently counting functions, are $\mathscr{C}$-compatible is denoted by $OF(n_1 \ldots n_m, \mathscr{C})$. It is clear that the sum of the two $\mathscr{C}$-compatible counting vectors, Y_1 and Y_2, is another $\mathscr{C}$-compatible counting vector.

Minimum sized orhogonal fractional factorial designs

In many practical situations, researchers are interested in finding minimum sized orthogonal fractional designs, i.e. fractional factorial designs that satisfy some orthogonality requirements *and* have the minimum number of points.

According to our formalization, the problem is equivalent to extracting one fraction $\mathscr{F}_*$ from $OF(n_1 \ldots n_m, \mathscr{C})$, such that the size of the fraction $\#\mathscr{F}_*$ is the smallest possible.

The problem can be written as $\min \underline{1}^T Y$ subject to $A_{\mathscr{C}} Y = \underline{0}$, where $A_{\mathscr{C}}$ is an integer matrix (see Corollary 1) and Y is the unknown counting vector.

We use lp_solve ([2]), a widely-used and well-known open source (Mixed-Integer) linear programming system. It is based on the revised simplex method and the branch-and-bound method for integers.

We experimented with this approach for various cases including sudoku designs (9 rows, 9 columns and 9 symbols). Sudoku grids are special cases of Latin squares in the class of *gerechte designs*, see [1]. As expected, we found a solution that has 81 points and that can be arranged in a 9×9 table as seen in newspaper puzzles.

A minimal basis for *all* the orthogonal fractional factorial designs

Given a homogeneous integer linear system $A_{\mathscr{C}} Y = 0$ whose solutions Y must be non-negative integers, the Hilbert Basis [8] is a minimal set of generators such that any solution Y becomes a linear combination of the generators with positive or null integer coefficients. Using 4ti2 [9], we computed Hilbert Bases for some cases. For example, for Orthogonal Arrays with 5 factors, 2 symbols and strength t, $OA(n, 2^5, 2)$ we found $26,142$ generators.

Sampling orthogonal fractional factorial designs

Let us consider the linear system $A_{\mathscr{C}} M = 0$ where $M = (m_\zeta)$ is a vector of *integer*, $m_\zeta \in \mathbb{Z}$. Given a $\mathscr{C}$-compatible counting vector Y_*, a solution M_* of $A_{\mathscr{C}} M = 0$ such that $Y_* + M_* \geq 0$ determines a new $\mathscr{C}$-compatible counting vector $Y_* + M_*$. If we want the size of the new counting vector $Y_* + M_*$ to remain the same as Y_*, a row whose values are all equal to 1 should be added to the matrix $A_{\mathscr{C}}$. We denote such a matrix by $A^1_{\mathscr{C}}$.

We use the theory of Markov Bases [3] to determine a set of generators of the moves M. We compute a Markov Basis of $\ker(A^1_{\mathscr{C}})$ using 4ti2 [9]. Once we have determined the Markov basis of $\ker(A^1_{\mathscr{C}})$, we make a random walk on the *fiber* of Y, where Y is the counting vector of an initial design $\mathscr{F}$. The fiber contains all the $\mathscr{C}$-compatible counting functions that have the same size as $\mathscr{F}$. The walk is done randomly choosing one move from the feasible ones, i.e. the moves for which we do not get negative values for the new counting function.

We considered $OA(8, 2^5, 2)$. We used 4ti2 [9] to obtain the Markov Basis. It contains $5,538$ different moves. We ran $1,000$ simulations and, by moving from one solution to another, obtained all the 60 different 8-run fractions.

4 Conclusion

Algebraic theory of OFFDs, based on polynomial counting functions and strata, transforms any mixed level orthogonal fractional factorial design into a solution of an integer system of linear equations. This opens the way to the use of a wide range of computational tools. The range of applications is limited only by the amount of computational effort required.

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Time series models for legal abortions in Italy

E. Foscolo, A. Luati, A. Lubisco and L. Pasquini [1]

1 Introduction

The rate of voluntary legal abortion in Italy is currently one of the lowest among developed countries. This is true despite the rate of foreign women (at the moment 28% of women in reproductive age) whose tendency to abortion is about three times that of the Italian female population[2]. Within this set, repeat abortions, up from the year of legalization until the late 80s - early 90s (30%), showed a decrease over time and seemed to move towards stability (25-26%, of which 22% is applicable to Italian women and 37% to foreign women). This trend is in line with forecasts by the models of Tietze and Jain (1978) and Tietze and Bongaarts (1982). These models were based on very restrictive assumptions, such as invariance of demographic structure and invariance of the risk of abortion across time and among all women, and did not take into account any previous experience of abortion. In this paper we specify stochastic models for legal abortions that take into account the number of past terminations. Furthermore, we shall include explicative variables for the phenomenon such as age of abortion, number of living children, marital status and education, to account for the variations in the population structure. The data that we shall use to fit the model are made of the voluntary terminations legally taken by women resident[3] in Italy between 1980[4] and 2007.

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[3] It is preferred to refer to women resident in Italy because of the substantial presence of foreign, whose socio-demographic composition is highly variable over time depending on the weight of the various nationalities. Nationality, is also closed related to abortion rate.

[4] 1980 is the year from which data on voluntary legal abortions are complete and reliable.

2 Time series models for legal abortions

We provide an approach based on the commonest observation–driven time series model for count data, i.e. the first-order integer autoregression (INAR(1)) model investigated by Al-Osh and Alzaid (1987) and McKenzie (1988). A brief account of the model is given here below. Let A be a random operator such that $A(Y)$ given Y=y has a distribution g $(\cdot|y)$. A stationary discrete time series with marginal distribution F_θ can be constructed as $Y_t=A_t(F_{t-1})+\varepsilon_t$, where F_{t-1} indicates the relevant past history of Y_t and ε_t are i.i.d. discrete innovations with finite first and second moments. The random operator $A(\cdot)$ preserves the integer status of the variables and ensures that the marginal distributions of the random variables (r.v.) Y_t belong to the same family of ε_t, by closure under convolution and infinite divisibility. Assuming a markovian dependence, the relevant past is concentrated on Y_{t-1} and we may specify the first order model Poisson integer autoregressive model (INAR(1))

$$Yt=\alpha\circ Y_{t-1}+ \varepsilon_t \tag{1}$$

where $\circ$ is the thinning operator (Steutel and van Harn, 1979) such that $\alpha\circ Y_{t-1}= \sum_{i=1}^{Y_{t-1}} B_{it}$ where $B_{1t}, \ldots, B_{Y_{t-1}t}$ are i.i.d. Bernoulli r.v. with $P(B_{it}=1)=\alpha$, and ε_t is the innovation, that we assume distributed like a Poisson r.v. with parameter λ and independent of B_{it}. By closure under convolution and infinitely divisibility, the marginal distribution of Y_t in (1) is itself a Poisson with parameter $\lambda/(1-\alpha)$. On the other hand, the conditional distribution of Y_t given $Y_{t-1}=y$ is the convolution between the (conditional) binomial distribution $g(\cdot|y)$ of $\alpha\circ Y_{t-1}$ and the Poisson distribution of ε_t, i.e. $p(Y_t|Y_{t-1})= \sum_{i=1}^{Y_{t-1}} g(r\mid \mathrm{Y}_{t-1}) f_\varepsilon(Y_t-r)$, which depends on the parameter θ=(α, λ). The INAR(1)-Poisson model decomposes discrete observations into two parts, a carry-over part which represents the influence of previous time periods and an innovation part which captures the effect of the present situation on the abortive behaviour. On an interpretative standpoint, $\alpha Y_t+\lambda$ represents the expected number of k^{th} abortions at time t conditional on the number of k^{th} abortions at time t-1. An extension of the Poisson INAR(1) model that accounts for over (under)-dispersion is provided by assuming a Generalized Poisson (GP) distribution (Jung and Tremayne, 2010) for the error term, with parameters λ and η. It will follow that the marginal distribution of Y_t will be Generalized Poisson and the parameter of interest for the inference will be θ=(α, λ, η) while g $(\cdot|y)$ will be a quasi-binomial with parameter the vector (y, α, λ, η). Inference on θ for first-order stationary (α<1) Markov models specified above may be tackled by using the maximum likelihood method. In the empirical applications that follow, numerical methods are employed in order to maximize the log-likelihood function. For the purpose of initializing the optimization algorithm, we use moment-based estimators. Moreover, the negative inverse Hessian of log-likelihood function, evaluated at the maximum θ, is used as an estimate of the variance-covariance matrix of the maximum likelihood estimator. All the computations are conducted using the statistical software R.

3 Analysis and conclusions

In this section we provide an empirical analysis based on the Generalized Poisson

INAR(1) models described above for our data. As in Tietze and Bongaarts (1982) we disaggregate the number of abortions from first to fifth order; shortly, Y_t^0, Y_t^1, Y_t^2, Y_t^3 and Y_t^4, where the exponent indicates the previous number of abortions. We also codify the observations into hundred integer values using sample quantiles.

The autocorrelation patterns suggest that a first-order model may be appropriate to capture the dynamics in the data. Maximum likelihood estimates together with estimated asymptotic standard errors for the parameters are given in Table 1.

Table 1: MLE of the GP INAR(1) for legal abortions (asymptotic standard errors).

	Y_t^0		Y_t^1		Y_t^2		Y_t^3		Y_t^4	
α	0.968	(0.004)	0.861	(0.104)	0.752	(0.071)	0.857	(0.061)	0.729	(0.070)
λ	2.864	(0.582)	15.48	(17.71)	23.40	(8.414)	2.448	(1.425)	1.812	(0.590)
H	-0.315	(0.062)	-0.550	(0.653)	-0.800	(0.171)	0.441	(0.147)	0.482	(0.108)
$L(\theta)$	-50.94		-65.08		-64.85		-79.36		-79.39	

In the GP INAR(1) model $E(Y^k_t|Y^k_{t-1})=\alpha Y^k_{t-1}+\lambda/(1-\eta)$. A value of α close to 1 implies a tendency to stability in the number of abortions over time. In our case we see a decline in the number of abortions of every order; in particular, the propensity towards first order abortions remains fairly stable, while it shows a significant reduction in the higher order abortions.

As a further step, we incorporate covariates that aim to account for the variation in the population structure. Specifically, we consider Poisson INAR(1) models where α is constant over time and λ is supposed in relationship with a p-dimensional vector of time-varying covariates, Z_t. Taking $\lambda_t=\exp(Z_t^{\top}\beta)$, $\beta\in\mathbb{R}^p$, will ensure that λ_t is positive. Four covariates were considered for our aim: age of abortion (15-24, 25-35, and 35-49 years); number of living sons (none=S0, one or more =S+); marital status (married=M, single=S, other=O) and education (elementary=EE, secondary=SE); the choice is based on the higher values of $L(\theta)$. Table 2 shows the maximum likelihood estimates together with estimated asymptotic standard errors for α and the coefficients β only corresponding to the relevant covariates for each order terminations.

Table 2: MLE of the Poisson INAR(1) for legal abortions with the estimated β associated with the covariates (asymptotic standard errors).

	Y_t^0		Y_t^1		Y_t^2		Y_t^3		Y_t^4	
α	0.984	(0.004)	0.982	(0.005)	0.976	(0.006)	0.723	(0.073)	0.575	(0.102)
35-49									0.324	(0.115)
S0	0.608	(0.329)								
S+			0.376	(0.161)	0.477	(0.150)	0.154	(0.076)		
O			2.035	(0.877)	2.648	(0.829)				
$L(\theta)$	-50.03		-51.15		-48.53		-71.81		-66.33	

The results show that education turns out to be never a significant explanatory variable. If abortion in the early ’80s was the prerogative of women with low education level (more than three quarters), over time the degree has become less discriminating and in more recent years the abortion affects almost equally women with low and high education. Age, which has a structure quite stable over time, influences high orders abortions (fifth and more) only with the class “elderly” (35-49 years). The number of living children plays an important role up to fourth order. In particular, the absence of living children, which now affects 42-43% of the women who have abortions, compared to 25% in the first years after legalization, seems to play a significant role on first order abortion (*nullipare* determined not to have children); on the other hand, the presence of living children is significant for abortions of second, third and fourth order, suggesting the existence of a subset of women who have already satisfied their desire for motherhood and that found in the repeated recourse to abortion the alternative to absent or ineffective contraception. Finally, the only significant mode of marital status is relative to divorced and separated; the weight of this mode has increased over time (it almost tripled, from 2.5% to 7%). In other words, it seems that being separated or divorced plays a significant role in explaining the (error mean of) second and third order abortions. It is reasonable that women with previous matrimonial experience, and perhaps with children, at a precarious moment in their lives do not hesitate to resort to abortion more than once in case of unwanted pregnancy.

Concluding, we carried out an exploratory analysis in order to study the phenomenon of legal abortions. A Generalized Poisson first-order integer autoregressive model is assumed for Italian data. Covariates are intended to account for changes in the structure of female population. The results lead to conclude that the model reveals a propensity to first order abortions for women without children and to higher order abortions for women that have children or are divorced or separated.

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Definitional aspects and classification criteria of occupations in the 150 years of the Italian Republic

Francesca Gallo, Pietro Scalisi

Abstract Data collection on occupations performed by individuals has always caused difficulties since the first population census in 1861. The nature of the individual answers, which are not usually very informative of the actual work contents, are such to require the definition of a structure able to properly classify them. The aim of the paper is to present the development of the classification logic and structure starting from the first population census of 1861 to the forthcoming 2011 census.

Key word: **classification of occupations, population censuses.**

1 Occupational data in the monarchical period censuses

Data on occupations have played a crucial role since the first Italian census of 1861[2], as well as the difficulties stemming from its collection and the efforts needed to guarantee high quality standard. Since 1861, the complexity and ambiguity of certain occupations is a reason of complain and is the main cause of the inability to infer, from the individuals responses, their position in the social hierarchy.

The condition or occupation (used as synonym until the 1901 census) whom the 1861 census refers to is the main one, that is the occupation in which the individual is more applied. Moreover, the 1861 census requires to specify whether the respondent

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[2] Even before the Italian union, with the Census of the Naples Kingdom of 31st December 1824, information on population distribution by '… district, sex, occupation and age' can be found.

is ‘Master or Servant’, and this information could be considered as a forerunner of the ‘status in occupation’ variable.

The classification logic used by the 1861 census arranges occupations into the type of industry they refer to. Eight out of nine major occupational groups are indeed related to economic activities categories: agriculture, industry for food, for clothing, for the construction, for furniture, for mineral and for trade and other industries.

The only major group that lies outside this logic is the one devoted to ‘liberal arts’; here we find occupations like alabasters, architects, lawyers, musicians, surgeons, priests, scientists, writers, journalists and teachers.

Although the 1861 census operations are conducted simultaneously in several European countries, international comparisons on occupations are precluded due to differences in the definitions. In Italy for instance, the occupation refers to the main job performed by an individual while in France the occupation concerns the job by which one or more individuals are able to live directly or indirectly (including housewifes).

The 1871 census starts the process towards a more detailed articulation of the occupational categories and towards a formalization of a hierarchical structure (see table 1).

With the 1881 census, a book entirely devoted to the classification of occupation, with a life independent of the data, is released for the first time. Thereafter, every census will provide the opportunity to revise and disseminate the new classification of occupations. It is worth to mention that the diversity of idioms in use in the different parts of the kingdom leads the 1901 census to publish an alphabetical list of occupations, arts and crafts with a reference to the place where they are in use[3].

It is emphasized the possibility to make comparisons with other countries' censuses. In fact, the 1901 list of occupations is based on the one adopted by several countries (France, Switzerland, Belgium, Germany, Austria, UK) in the first meeting of the International Institute of Statistics.

As in the past, difficulties in ensuring a high level of data quality on occupations are highlighted, mainly due to the use of dialectal expressions, complex to decode, or to the different meaning attributed to the same name in different part of the territory[4].

The 1911[5] and 1921 censuses do not introduce significant innovations in the field of occupational data collection, but, because of the new census on enterprises, the separation between the concepts of occupation (‘the way in which individuals contribute to production’) and economic activity (‘the kind of product obtained’) begins to emerge. This separation will be made in operational terms in the 1931 census; from then on, the population censuses classify the population according to the occupation (in 1936 called subjective classification) and the economic activity category where the occupation is performed (the so called ‘objective classification’).

Comments on the problem of false declaration of occupations are clearly mentioned in the publications of the Fascist censuses. The reasons of this problem are addressed to the ‘fear of fiscal controls’ or ‘control on trade union memberships’ or ‘on missed contributions for compulsory social security’ and moreover to ‘pride

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[3] We find for instance *azzimatore* (Naples), *sottano* (Veneto), *sostraio* (Milan), *zavarino* (Naples).

[4] *Fossaiuolo* identifies both the ‘digging of ditches’ and the ‘undertaker’; *limonaro* is the citrus grower in Sicily, elsewhere is the person who sells lemonade and other drinks.

[5] In this year the first census of factories and industrial enterprises is also carried out.

reasons'. In fact we read for the first time '..it is likely that a number of people in humble occupations have declared a different position (higher) to the real one for social desirability reasons.'

Table 1: *Structure of the classification of occupations in the 1861-2011 censuses (*)*

…	1st level	2nd level	3rd level	4rt level	5th level
1861 census[6]	10	17			
1871 census …	16	46			
1881 census	18	45	368		
1901 census	5	31	290		
1911 census	10	52	301		
1921 census	10	52	179		
1931 census	14	56	339		
1936 census	10	36	344		
1951 census	2	38	361		
1961 census	9	39	297		
1971 census	9	53	248		
1981 census	9	53	247		
1991 census	9	35	119	601	
2001 census	9	37	121	519	
2011 census	9	37	129	511	800

(*) 1861-1991 classifications of occupations devoted a specific group to non-occupational conditions. For comparability reasons this group has not been considered in the figures.

2 Occupational data collection in the Italian Republic Censuses

The post-war census adopts the Official Classification of Occupations (1951) and defines for the first time 'occupation', along with arts and crafts, as individual activities carried out by members of the working population. Contrary to the past when occupation was considered a subjective variable (as in the 1936 census), work is now an objective fact and not a personal attribute as it is detectable in space and time. The employment specificity is intended as a "technological qualifications" of individual activities and "it is determined by the kind of work or service performed (for instance, manufacturer, trader, doctor, accountant, gardener, carpenter, etc.)".

The introduction to the classification states a relevant distinction between activities that mainly require an intellectual effort – "occupations" - and activities that require a physical effort – "arts and crafts". In later years this distinction will continue to be used, but the nominalistic difference will disappear in favour of a single term "occupation".

The coding system is still based on the economic activity criterion. This logic if, on the one hand, confirms the natural correlation between the individual and the

[6] In this Census there was no real classification but rather a list of occupation examples appropriately revised for data dissemination.

collective economic activities, on the other hand, gives priority to the economic context in which the worker carries out his job, joining together different occupations on the basis of common purpose to produce a particular good or service. It's interesting to note that this principle, which links occupations and economic activities, is not applied in two classification groups. They are considered as exceptions, because they enclose occupations which can be carried out in different contexts.

In 1957 the Ninth International Conference of Labour Statisticians adopts the first official version of the Classification of Occupations, known as ISCO-58. Despite the differences between the national and the international coding criteria – Isco focuses on the characteristics of the work and not on the branch of economic activity - data comparability has always been guaranteed by Italy.

The internal structure and criteria of the classification remain stable until 1981. In 1991 the Classification introduces a radical innovation in its structure documenting the deep economic changes occurred in the eighties and anticipating the technological changes expected in the coming years. The new framework aims essentially to reflect the great increase of the tertiary sector in the productive system. The composition of the nine major groups of occupations shows the narrowing of agricultural and industrial workers and the increase of the intellectual ones[7]. For the first time, the recognition of non-occupational conditions (students, housewives, retired, etc.) falls outside the classification. Changes in Italian classification incorporate the new features of the revised International Standard Classification of Occupation (ISCO-88). This defines a job "as a set of tasks and duties executed by one person" and introduces a new classification criteria based on the concept of 'skill' required to carry out tasks and duties. Skill has a twofold dimension: the 'skill level' – which is a function of the complexity and range of the tasks and duties involved – and the 'skill specialization' – defined by the field of knowledge required, the tools and machinery used, the materials worked on or with, as well as the kinds of goods and services produced. These last elements recall the concept of economic activity, however relegating it to a secondary role compared to the centrality taken in the previous classifications. The new classification, in other words, is strongly based on the type of work performed. Its hierarchical structure classifies occupations according to the different levels of autonomy and responsibility and to the different skill required. Compared to the previous classification, a fourth level of detail is introduced to better distinguish occupations. In the 2001 and 2011 censuses, Classifications are further renewed and refined but they maintain the 1991 criteria. The main changes of the 2011 Classification are the introduction of a fifth-hierarchical level and of an exhaustive description of each level of classification. In this way the Classification becomes an analytical tool to represent job contents. The 2011 classification reflects the main innovations introduced by the last edition of ISCO08 to report changes in work contents and organization.

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[7] Manual occupations, which accounted for three-quarters of the post-war workforce, in 1991 accounted for less than 50 percent of employed. On the contrary, the intellectual occupations, which included 2.324.000 employees in 1951, have almost tripled in 1991.

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The “administrative” territory from the Unity of Italy to the present. An *overview* through the history of municipalities and provinces.

Orietta Gargano[1], Tiziana Clary[2]

Abstract This work is intended to be an analysis of the historical changes occurred over time and space in the constitution of municipalities and provinces (administrative units) from the Unification of Italy up to now. For the first time in the last few years a systematic and accurate work was carried out for a full recovery of sources and acts tracing the historical path of the Italian administrative units.
All data were collected and organized in an information system providing their integrated management and availability on-line.

Keywords: administrative units; administrative and territorial variations; land area.

1 The evolution of the territory and administrative units

When the Kingdom of Italy was established, the national territory corresponded to the current 59 provinces and 15 departments (now named regions). There were 7.720 municipalities. The total area, according to the present boundaries, measured 256.240 sq. km.

This framework has evolved through different historical periods. Following the war between the Kingdom of Italy and the Austro-Hungarian Empire (the third war of Independence), in 1866 the territory of Veneto - Friuli included - and the province of Mantua were annexed. After the union of the former Hapsburgic provinces (Belluno, Padua, Rovigo, Treviso, Venice, Verona, Vicenza) and the annexation of Rome in 1870, the total number of provinces amounted to 69.

The provinces of the present Trentino-Alto Adige and Venezia Giulia were annexed in 1920, while three new provinces (La Spezia, Trieste and Ionian) were established in 1923. In 1924, with the annexation of Zara (Zadar), Istria (Pula) and Carnaro (Rijeka), a total land area of 8.953 sq. km, the number of provinces raising to 76, Italy reached its largest territorial extent. This extension would permanently settle down in 1947 with the assignments agreed upon in the Treaty of Paris disposing of 33 municipalities in the province of Gorizia, 15 of Trieste, in addition to the whole districts of Rijeka, Zadar and Istria for a total of 7.625 sq. km. At the present time, the total land area is of 301.336 sq. km.

Once consolidated the national boundaries, only the internal disposition of the administrative units, relating to the number of provinces and municipalities, has been modified.

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17 new provinces were established in 1927. The province of Caserta was abolished but later re-established, in 1945. At the birth of the Republic, there were 91 effective provinces in Italy.

As regards Aosta province, the power was transferred to the newly-formed region with special status, in 1948. In 1974, even considering Aosta Valley, 95 provinces could be counted. Their number increased further on with the establishment of eight new provinces, in 1992; four new provinces became operative in Sardinia in 2005 and finally, three more units (Monza e della Brianza, Fermo, Barletta-Andria-Trani) were added in 2009. At the present time the provinces are 110.

There were 8.382 municipalities in 1871. Through various fluctuations they reached 9.194 units in 1921. In the following decade 2.189 municipalities were suppressed (23.8%), then they increased again in 1951 (+6.8 % compared to 1931) and they amounted to 8.035 units in 1961 (+2.9 % over the previous decade). Since then there has been a slight but steady increase up to a substantial stabilization starting from 1991 onward. Dating from March 1st 2011, the municipalities are 8.092.

Table 1 *Number of existing Municipalities at the time of censuses classified by Geographic areas*

Geographic areas	*1861*	*1871*	*1881*	*1901*	*1911*	*1921*	*1931*	*1936*
North-west	4.064	3.769	3.686	3.681	3.699	3.702	2.689	2.689
North-east	364	1.118	1.115	1515	1.125	1.968	1.436	1.429
Centre	707	927	901	907	915	927	937	943
South	1.855	1.840	1.836	1.838	1.860	1.873	1.625	1.648
Isles	730	728	721	721	724	724	624	630
Italy	7.720	8.382	8.259	8.262	8.323	9.194	7.311	7.339

Table 1 *Number of existing Municipalities at the time of censuses classified by Geographic areas*

Geographic areas	*1951*	*1961*	*1971*	*1981*	*1991*	*2001*	*2011*
North-west	2.960	3.057	3.064	3.064	3.064	3.061	3.059
North-east	1.412	1.484	1.482	1.481	1.481	1.480	1.480
Centre	982	992	998	1.000	1.001	1.003	996
South	1.752	1.771	1.638	1.787	1.789	1.790	1.790
Isles	704	731	738	754	765	767	767
Italy	7.810	8.035	8.056	8.086	8.100	8.101	8.092

1.1 Administrative variations

Over time, from an administrative standpoint, there has been a rather lively dynamics involving the actual existence of municipalities, the establishment of municipalities and provinces, the setting up of new regions, naming changes – variously concerning all types of administrative entities - and variations in municipality districts (acquisition and/or disposal of land portions).

Any variation occurring and being recorded is bound to a formal Act ratifying it and identifying its starting (temporal or administrative validity). Six different types of variation have to be pointed out: CS establishment and/or annexation to the national territory; ES suppressions; CE/AQ land disposal and acquisitions between municipalities; AP variations in the composition of provinces; CD denomination changes.

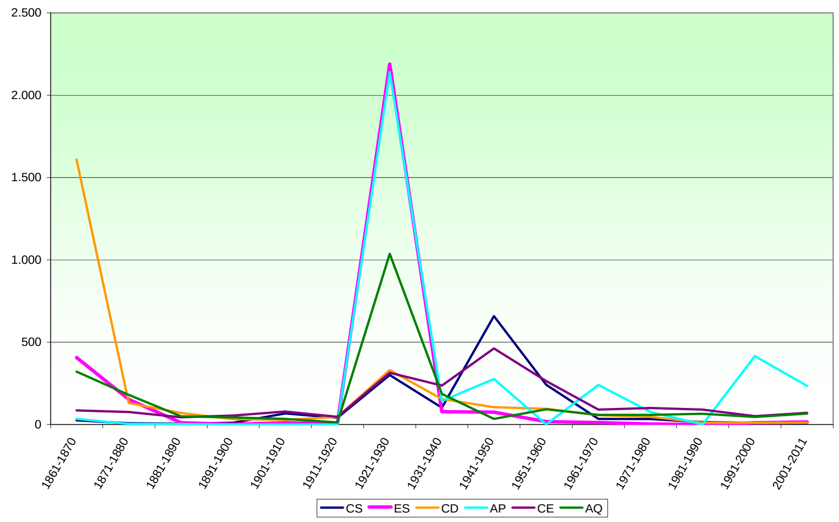
The distribution of variations, by type, year and territorial reference has not a uniform trend either in time or territory.

Denomination changes took place mostly in the years from 1861 to 1870 (1609 cases, 59% of the total). The geographical area with the highest occurrence was the North-west (707 events); the highest figure (394) in Lombardy.

Municipalities suppression was also a significant phenomenon in the above said decade (407 cases- 13,6 % of the total) but the peak was reached in the years from 1921 to 1930: 2.189 cases, for the most part in the North (1.199 in the North-west ; 601 in the North-east, of which 384 in Venezia Tridentina, now Trentino-AltoAdige).

The decade 1921-1930 even holds a record regarding changes in belonging to provinces or to regions: 2.139 cases, 60% of the total, a result mostly due to the creation of 17 new provinces, in 1927, involving the whole national territory.

Figure 1 *Variations range from 1861 to 2011*



The second high value (311 municipalities) is to be found in more recent years (1991-2000) when eight new provinces were established, largely in the North-west.

The setting up of new municipalities was more frequent through the years 1941-1950: 658 new municipalities were set up, of which about half in the North-west (333), 103 in the North-east and 103 in the South. Such an occurrence can also be observed in the periods 1921-1930 and 1951-1960. In both times, a greater number of new municipalities were in the North-west. Territorial variations or exchange of territories between municipalities are not a prominent phenomenon. Yet, even acquisitions show a very high frequency in the decade 1921-1930.

In that period of time, assignments ranked second in frequency while the largest amount of land disposal is remarked from 1941 to 1950.

In short, the density of events is basically focused in the twenties, particularly in the North; only as regards name changes, the maximum density occurs in the period 1861-1870, particularly in the North-east, with 43.9%.

Variability, however, showed a downward trend from the end of the war to more recent years. Starting from 1960 there has been some stability both in the distribution of administrative units and in their territorial composition. The only exception is the change in the belongings of municipalities to provinces and regions, a phenomenon in turmoil even in more recent decades, due to the establishment of new provinces.

2 Future prospects

The availability of information on-line will be of great benefit to researchers and practitioners making it possible for them to know in real time the exact consistency of administrative units and the "n" decision made over time for each of them. Last step, but not least, is the pursuit of an objective not achieved yet, though planned, that is the unique coding of all the instances taken by the administrative units of the system, with reference to the relevant administrative area at the time of the change. The code, structured, will have a purely statistical significance and will contain references to the year of variation, the Istat coding standard of the territorial administrative unit and the type of variation.

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A distributional approach for measuring wage discrimination and occupational discrimination separately

Giaimo R.[1], Lo Magno G. L.[2]

Abstract Studies adopting the distributional approach in analysing gender discrimination in the labour market (Jenkins, 1994; Del Rìo et al., 2010) pay little attention to the issue of the separate measuring of wage discrimination and occupational discrimination. Instead, our paper uses the Foster-Greer-Thorbecke indices for measuring wage discrimination and occupational discrimination separately. Similar to the technique employed in the Brown-Moon-Zoloth decomposition (1980), we have thus used a multinomial model to estimate the theoretical distribution of women in occupation, in the absence of occupational discrimination.

Key words: wage discrimination, occupational discrimination, distributional approach

1. Introduction

The analysis of gender discrimination is a classic topic in labor market studies. The standard approach to measure wage discrimination is the Blinder-Oaxaca (1973) decomposition, in which the hourly wage differential between men and women is decomposed as follows:

$$ln\overline{W}_M - ln\overline{W}_F = \overline{\boldsymbol{Z}}_M\left(\widehat{\boldsymbol{\beta}}_M - \widehat{\boldsymbol{\beta}}_F\right) + (\overline{\boldsymbol{Z}}_M - \overline{\boldsymbol{Z}}_F)\widehat{\boldsymbol{\beta}}_F \tag{1}$$

where $ln\overline{W}_M$ and $ln\overline{W}_F$ are the mean of the logarithms of observed wage of men and women respectively, $\overline{\boldsymbol{Z}}_M$ and $\overline{\boldsymbol{Z}}_F$ are vectors of individual characteristics affecting

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wage and $\hat{\boldsymbol{\beta}}_M$ and $\hat{\boldsymbol{\beta}}_F$ are OLS estimates from regressing, separately by sex, logarithm of hourly wage on those characteristics. Other analogue decompositions, using different weightings of differences in individual characteristics, are provided by Reimers (1983), Cotton (1998), Neumark (1988) and Oaxaca and Ransom (1994).

Jenkins (1994) criticizes this approach because it doesn't adequately take into account the distribution of wage discrimination experienced by each woman. In fact it can be shown that evaluation of wage discrimination, carried out through the use of the Blinder-Oaxaca decomposition, can lead to the conclusion of absence of discrimination when positively discriminated women are compensated by negatively discriminated women, even if there is no conceptual doubt that discrimination is present. Jenkins underlines a common aspect of poverty and discrimination: the latter can be also viewed as a form of deprivation of the wage women would receive when no discrimination penalize them. So the framework of poverty analysis can be employed to analyse discrimination.

Del Río et al. (2010) agree with the distributional approach by Jenkins and employ the family of indices by Foster, Greer e Thorbecke (1984) (FGT), originally proposed for poverty analisys, for the study of wage discrimination:

$$D_\alpha = \frac{1}{n_F} \sum_{i \epsilon P} \left(\frac{\hat{R}_{Fi} - \widehat{W}_{Fi}}{\hat{R}_{Fi}} \right)^\alpha, \quad \alpha \geq 0 \tag{2}$$

where n_F is the number of all women, $\hat{R}_{Fi}$ is the expected wage that woman would receive if she were not discriminated, $\widehat{W}_{Fi}$ is the expected wage, P is the set of labels identifying discriminated women, i.e. women for wich $\hat{R}_{Fi} - \widehat{W}_{Fi} > 0$, and α is an integer, which can be interpreted as an aversion parameter to discrimination. When $\alpha = 0$, the index is an head-count ratio of discriminated women; when $\alpha > 0$ the index measures the intensity of discrimination. The larger the value of α, the greater the emphasis on the most discriminated woman.

The distributional approach by Jenkins and Del Río et al. focuses on wage discrimination but provides no information regarding occupational discrimination.

2. Wage discrimination and occupational discrimination

Occupational segregation is the differential distribution of men and women across occupations; it can be due to employees' differences in tastes or market discrimination practiced by employers. We refer to the latter aspect as occupational discrimination.
In order to assess the effect of occupational discrimination on the wage differential, a counterfactual distribution of men and women across occupation is necessary, in which occupational attainment is only explained by individual characteristics and various other market factors, but not employers' aversion. This idea is used in the decomposition by Brown, Moon and Zoloth (1980), where a multinomial model is used to estimate the counterfactual distribution of women in occupations. This decomposition obtains an evaluation of wage discrimination and occupational discrimination separately, but not one which is based on the distributional approach.

Following Brown-Moon and Zoloth, we first estimate two logit multinomial occupational attainment model with k occupations, separately by sex. Then we use estimates to assess the probability of a woman with characteristics $\boldsymbol{X}_{Fi}$ to be employed in occupation j and the probability to be employed in the same occupation if she were evaluated by the labor market as a man. The two estimated multinomial model provide us with k estimated vectors of parameter $\widehat{\boldsymbol{\gamma}}_{Mj}$ for men and k estimated vectors $\widehat{\boldsymbol{\gamma}}_{Fj}$ for women. We also estimate lognormal wage equations, separately by sex and occupation, using individual characteristics $\boldsymbol{Z}_{Mi}$ for men and $\boldsymbol{Z}_{Fi}$ for women, resulting in k OLS estimated vectors $\widehat{\boldsymbol{\beta}}_{Mj}$ and $\widehat{\boldsymbol{\beta}}_{Fj}$. All the estimated parameters are used to predict, for each woman, the expected wage in absence of occupational discrimination:

$$\widehat{U}_{Fi} = \sum_{j=1}^{k} \left[\frac{exp\left(\boldsymbol{X}_{Fi}\widehat{\boldsymbol{\gamma}}_{Mj}\right)}{1 + \sum_{h=2}^{k} exp(\boldsymbol{X}_{Fi}\widehat{\boldsymbol{\gamma}}_{Mh})} exp\left(\boldsymbol{Z}_{Fi}\widehat{\boldsymbol{\beta}}_{Fj} + \frac{\hat{\sigma}_F^2}{2}\right)\right] \tag{3}$$

the expected wage in absence of wage discrimination:

$$\widehat{R}_{Fi} = \sum_{j=1}^{k} \left[\frac{exp\left(\boldsymbol{X}_{Fi}\widehat{\boldsymbol{\gamma}}_{Fj}\right)}{1 + \sum_{h=2}^{k} exp(\boldsymbol{X}_{Fi}\widehat{\boldsymbol{\gamma}}_{Fh})} exp\left(\boldsymbol{Z}_{Fi}\widehat{\boldsymbol{\beta}}_{Mj} + \frac{\hat{\sigma}_M^2}{2}\right)\right] \tag{4}$$

and, finally, the (not adjusted) expected wage:

$$\widehat{W}_{Fi} = \sum_{j=1}^{k} \left[\frac{exp\left(\boldsymbol{X}_{Fi}\widehat{\boldsymbol{\gamma}}_{Fj}\right)}{1 + \sum_{h=2}^{k} exp(\boldsymbol{X}_{Fi}\widehat{\boldsymbol{\gamma}}_{Fh})} exp\left(\boldsymbol{Z}_{Fi}\widehat{\boldsymbol{\beta}}_{Fj} + \frac{\hat{\sigma}_F^2}{2}\right)\right] \tag{5}$$

where, in order to estimate the expected value of a lognormal distributed variable of parameter (μ, σ^2), we use the consistent estimator $exp(\hat{\mu} + \hat{\sigma}^2/2)$ (in which $\hat{\mu}$ and $\hat{\sigma}^2$ are unbiased estimators of μ and σ^2), and the first factor in each of the summations are probabilties, estimated through the logit multinomial models of occupational attainment.

We obtain the distributional index of occupational discrimination:

$$\widehat{D}_O^\alpha = \frac{1}{n_F} \sum_{i \in P_O} \left(\frac{\widehat{U}_{Fi} - \widehat{W}_{Fi}}{\widehat{U}_{Fi}} \right)^\alpha, \quad \alpha \geq 0 \tag{6}$$

where the set P_O identifies women for which $\widehat{U}_{Fi} - \widehat{W}_{Fi} > 0$ and the integer α can be interpreted as an aversion parameter to occupational discrimination, and the distributional index of wage discrimination:

$$\widehat{D}_W^\alpha = \frac{1}{n_F} \sum_{i \in P_W} \left(\frac{\widehat{R}_{Fi} - \widehat{W}_{Fi}}{\widehat{R}_{Fi}} \right)^\alpha, \quad \alpha \geq 0 \tag{7}$$

where the set P_W identifies women for which $\widehat{R}_{Fi} - \widehat{W}_{Fi} > 0$ and the integer α can be interpreted as an aversion parameter to wage discrimination.

3. Empirical analysis

We employed our distributional indices in analyzing gender discrimination in Italy, using the Eu-Silc Italian data for 2006. The sample we considered comprised at least 16-years old employees, who were in receipt of a paid work when interviewed; the sample includes 8,333 men and 6.677 women. The sample share of women working in top occupations (Isco 1 and 2) was 11.1% and 10.4% for men. Eight of the nine occupations of the Isco-88 (COM) one-digit classification have been considered in our analysis, excluding the armed forces. Variables used for the multinomial logit models are number of years in education, years of work experience, and dummy variables for the region of residence (the North, Center or South of Italy). Variables used for the lognormal wage equations vary from occupation to occupation; they are generally the same used in the multinomial models plus worked hours in a week and economic activity. In calculating our discrimination indices, we use different values of the parameter α to provide discrimination evaluations at different levels of aversion to discrimination (interpretation is straightforward only when $\alpha = 0, 1$). The results are shown in Table 1 below.

Table 1: Indices of occupational discrimination and wage discrimination

α	$\widehat{D}_O^\alpha$				$\widehat{D}_W^\alpha$			
	North	Center	South	Italy	North	Center	South	Italy
0	0.132	0.037	0.004	0.082	0.993	0.987	0.973	0.987
1	0.004	0.000	0.000	0.002	0.154	0.140	0.124	0.144
2	0.000	0.000	0.000	0.000	0.028	0.024	0.020	0.025
3	0.000	0.000	0.000	0.000	0.005	0.005	0.004	0.005

Source: Authors' calculations using Italian Eu-Silc 2006 data.

These results demonstrate that 98.7% of Italian women suffer wage discrimination, while women suffering occupational discrimination are only 8.2%. Discrimination is more marked in the north of Italy but differences between the various regions do not tend to be significant for higher values of α. We further demonstrated that wage discrimination in Italy - as a phenomenon - is more significant than occupational discrimination, thus providing us with an interesting interpretation of the gender pay gap.

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Specification issues in latent growth models with multiple indicators

Leonardo Grilli and Roberta Varriale

Abstract In this paper we focus on a multi-item Latent Growth Curve (LGC) model for modelling change across time of a latent variable measured by multiple items at different occasions: in the structural part the latent variable grows according to a random slope linear model, whereas in the measurement part the latent variable is measured at each occasion by a conventional factor model with time-invariant loadings. The specification of a multi-item LGC model involves several interrelated choices: indeed, the features of the structural part, such as the functional form of the growth, are linked to the features of the measurement part, such as the correlation structure across time of measurement errors. In the paper, we give guidelines on the specification of the variance-covariance structure of measurement errors. In particular, we investigate the empirical implications of different specification strategies through an analysis of student ratings collected in four academic years about courses of the University of Florence. In the application we compare the compound symmetry correlation structure with the independence structure. In particular, we discuss the implications of the two specifications in terms of interpretability of the results.

Key words: latent growth curve model, longitudinal correlation, model selection, second-order LGC, student ratings

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1 Introduction

Latent Growth Curve (LGC) models aim at modelling change across time. While traditional LGC models are based on a single observed indicator, we focus on a multivariate extension, namely a LGC model with multiple indicators for modelling change across time of a latent factor which is measured at different occasions by several items. This model is also labelled *curve-of-factors*, *second-order LGC* and *multiple-indicator multilevel growth model*: see McArdle (1998), Merdith and Tisak (1990), Hancock (2001), Muthén (2004), Bollen and Curran (2006), Ferrer *et al.* (2008), Steele (2008), and Wu *et al.* (2010).

A multi-item LGC model aims at measuring the change in the latent variable (factor) across time by accounting for both the interrelationships of the observed variables (indicators) within each occasion and the interrelationships of the same indicator across occasions. In order to estimate the parameters and to make extensions it is useful to view the LGC as a Structural Equation Model (SEM). We consider a widely used form, namely a structural equation model composed by a structural part with a latent variable growing according to a random slope linear model and a measurement part specifying that the latent variable is measured at each occasion by a conventional factor model with time-invariant loadings.

The specification of a multi-item LGC model involves several interrelated choices. In particular, the features of the structural model, such as the functional form of the growth, are linked to the features of the measurement model, such as the correlation structure across time of the measurement errors. In empirical works the specification choices are justified by theoretical arguments (e.g. measurement invariance) or by the parsimony principle (e.g. linearity of the growth), but sometimes the choices do not appear to be well grounded. The assumptions on the measurement errors are often not given much emphasis, but we show that they are relevant in many respects. We discuss the choice of different specifications of the correlation structure of the measurement errors through an application to the change of student satisfaction about university courses. Specifically, we analyse student ratings collected in four academic years over the period 2005-2008 about courses of the School of Economics of the University of Florence.

2 The multi-item latent growth model

In order to define a multi-item LGC model, let y_{kti} denote the value of item k at occasion t for object i. In the context of student ratings, y_{kti} is the average mark of questionnaire item k at academic year t for course i. The multi-item LGC model is defined by a measurement model and a structural model, following the usual SEM formulation. We consider a classical version where the *measurement model* is

$$y_{kti} = \lambda_{0k} + \lambda_{1k} y^{*}_{ti} + m_{kti} \tag{1}$$

where y^*_{ti} is a latent variable representing the construct of interest, λ_{0k} is an item mean, λ_{1k} is a factor loading and m_{kti} is measurement error. The measurement errors m_{kti} are assumed to have a multivariate normal distribution and a variance-covariance structure which can be specified in several alternative ways as discussed below.

As for the *structural model*, we assume a linear growth function where both the intercept and the slope randomly vary across objects:

$$y^*_{ti} = \alpha_{0i} + \alpha_{1i} z_t + e_{ti} \tag{2}$$

$$\alpha_{0i} = \alpha_0 + u_{0i} \tag{3}$$

$$\alpha_{1i} = \alpha_1 + u_{1i} \tag{4}$$

where z_t is the timing of occasion t, whereas α_{0i} and α_{1i} are the intercept and slope of the growth line of object i. The random effects u_{0i} and u_{1i}, accounting for deviations of the line of object i from the population line $\alpha_0 + \alpha_1 z_t$, are iid with a bivariate normal distribution with zero means and $var(u_{0i}) = \sigma^2_{u_0}$, $var(u_{1i}) = \sigma^2_{u_1}$ and $cov(u_{0i}, u_{1i}) = \sigma_{u_{01}}$. For identification, $\alpha_0 = 0$ or, alternatively, $\lambda_{0k} = 0$ for a reference item k. The error e_{ti} represents the deviation of the latent variable from the model line at occasion t for object i. The errors e_{ti} are independent across objects and occasions and they have a normal distribution with zero mean and variance $var(e_{ti}) = \sigma^2_e$. Note that the multi-item LGC has three sets of errors: measurement errors (m_{kti}), deviations of the latent construct from values predicted by the object-specific line (e_{ti}) and deviations of the object-specific line from the population line (u_{0i}, u_{1i}). Errors belonging to different sets are assumed to be independent.

The structural model (2) assumes that at any occasion the timing of measurement is the same for all objects. This is the case in the analysis of student ratings since the occasion corresponds to the academic year. When the occasions are equally spaced, as in our example, the time variable z_t is a sequence of equally spaced numbers: the usual choice is 0,1,2,... so that the intercept is the mean level at the initial occasion and the slope is the mean variation between two adjacent occasions.

The number of measurement occasions may vary across objects, e.g. because of attrition. In our application we consider the courses evaluated at least two times, so there are non-monotone missing patterns. Missing occasions are problematic with traditional estimation methods based on the covariance matrix (a possible solution being a multi-group analysis by missingness patterns); however, full information maximum likelihood does not require complete data and the resulting estimators are consistent under the standard Missing At Random assumption.

The multi-item LGC model can easily be extended to include explanatory variables in the measurement part and/or in the structural part. The extension to occasions with object-specific timings (namely, z_{ti} instead of z_t) is straightforward in principle, though it is not feasible with estimation approaches treating the time variable as a factor loading (Steele 2008).

3 Specification of the longitudinal covariance matrix of measurement errors

In this paper, we focus on the specification of the variance-covariance structure of the measurement errors. We assume, as usual in the literature, that the measurement errors m_{kti} are independent across items given the latent factor y^*_{ti}, which amounts to assuming that the factor model is well specified. We also allow for the measurement variances to be different across items. The point is how to specify the variance-covariance structure of each item across occasions, keeping in mind that the assumptions on the covariances are far more important that the assumptions on the variances.

As for the measurement variances, each item may have a constant variance or a time-varying variance. This feature determines the type of factorial invariance (Ferrer *et al.* 2008): the time-invariance of loadings and item means in the measurement model (1) implies *strong factorial invariance*; if also the measurement variances are constant across time, then there is *strict factorial invariance*. While the strong version is essential for the interpretation of the latent growth curve, the strict version is not essential and indeed it may be an inappropriate restriction.

As for the measurement covariances across occasions, the main covariance structures used in the literature are: (*a*) *independent*: $cov(m_{kti}, m_{kt'i}) = 0$ for any couple of occasions t, t'; (*b*) *lag-1 correlation*: $cov(m_{kti}, m_{kt'i}) = constant$ for adjacent occasions t, t', and $cov(m_{kti}, m_{kt'i}) = 0$ otherwise; (*c*) *compound symmetry*: $cov(m_{kti}, m_{kt'i}) = constant$ for any couple of occasions t, t'; (*d*) *unstructured*: $cov(m_{kti}, m_{kt'i})$ takes a different value for any couple of occasions t, t'.

The unstructured covariance matrix entails a large number of parameters: in case of T occasions, there are T variances and $T(T-1)/2$ covariances for each item. Parsimonious alternatives to independent errors are *lag-1 correlation* and *compound symmetry*, where the correlation is regulated by a single parameter for each item. The compound symmetry correlation is a convenient choice when using estimation algorithms allowing for hierarchically nested latent variables since it is obtained by the following variance component model for the measurement errors (Steele 2008):

$$m_{kti} = r_{ki} + s_{kti} \tag{5}$$

where r_{ki} and s_{kti} are zero-mean iid errors with variances $\sigma^2_{r,k}$ and $\sigma^2_{s,k}$, respectively. Thus $var(m_{kti}) = \sigma^2_{r,k} + \sigma^2_{s,k}$ for any occasion t (time-constant variance), whereas $cov(m_{kti}, m_{kt'i}) = \sigma^2_{r,k}$ for any couple of occasions t, t'.

The role of the assumptions can be evaluated by looking at the model-predicted variances and covariances. As for the latent construct, the multi-item LGC model defined by equations (1) to (4) implies

$$\begin{aligned} var(y^*_{ti}) &= \sigma^2_{u_0} + \sigma^2_{u_1} z_t^2 + 2\sigma_{u_{01}} z_t + \sigma^2_e \\ cov(y^*_{ti}, y^*_{t'i}) &= \sigma^2_{u_0} + \sigma^2_{u_1} z_t z_{t'} + \sigma_{u_{01}} (z_t + z_{t'}). \end{aligned}$$

As for the items, the variance is:

$$\begin{aligned} var(y_{kti}) &= \lambda_{1k}^2 var(y_{ti}^*) + var(m_{kti}) \\ &= \lambda_{1k}^2(\sigma_{u_0}^2 + \sigma_{u_1}^2 z_t^2 + 2\sigma_{u_{01}} z_t + \sigma_e^2) + var(m_{kti}). \end{aligned} \quad (6)$$

The item covariances are of two main types: the cross-item covariance between two distinct items at a given occasion and the longitudinal covariance between a given item at two distinct occasions. Specifically, the *cross-item covariance* between item k and item k' at occasion t for object i is

$$cov(y_{kti}, y_{k'ti}) = \lambda_{1k}\lambda_{1k'} var(y_{ti}^*) = \lambda_{1k}\lambda_{1k'}(\sigma_{u_0}^2 + \sigma_{u_1}^2 z_t^2 + 2\sigma_{u_{01}} z_t + \sigma_e^2),$$

whereas the *longitudinal covariance* between item k at occasion t and the same item at occasion t' for object i is

$$\begin{aligned} cov(y_{kti}, y_{kt'i}) &= \lambda_{1k}^2 cov(y_{ti}^*, y_{t'i}^*) + cov(m_{kti}, m_{kt'i}) \\ &= \lambda_{1k}^2[\sigma_{u_0}^2 + \sigma_{u_1}^2 z_t z_{t'} + \sigma_{u_{01}}(z_t + z_{t'})] + cov(m_{kti}, m_{kt'i}). \end{aligned} \quad (7)$$

The longitudinal covariance is the sum of two components, one from the structural model and one from the measurement model (which is left unspecified as it depends on the choice about the covariance structure of the measurement errors). While the longitudinal covariance is estimable from the data, the two components can be disentangled only by virtue of assumptions. In the applications it is crucial to evaluate how the estimates of the parameters of the growth model, which are of primary interest, are sensitive to the assumptions on the measurement errors.

In order to specify a multi-item LGC model we suggest to follow a mixed strategy based on the following points: (*i*) justify the assumptions on the basis of the knowledge of the phenomenon and the data collection mechanism; (*ii*) compare the fit of different specifications using fit indexes, such as the Bayesian information criterion (BIC); (*iii*) for each specification, compare the observed and model-predicted covariance matrices (in particular, the longitudinal covariance matrices of each item); (*iv*) compare the competing specifications in terms of interpretability and substantive conclusions. These points are illustrated in the following application focussing on the specification of the longitudinal covariance matrix of the measurement errors.

4 Application: longitudinal analysis of student ratings

We investigate the empirical implications of different specification strategies of the LGC model for multiple indicators through an application to the change of student satisfaction with university courses. Specifically, we analyse student ratings collected in four academic years (period 2005-2008) at the School of Economics of the University of Florence. The object of evaluation is a course taught by a given teacher, e.g. Statistics taught by teacher A is distinct from Statistics taught by teacher

B. We consider a course to be evaluated at a given occasion if at least 6 ratings were collected and we keep only the courses with at least two evaluations over the period 2005-2008. Consequently, the sample includes 346 courses (78 evaluated at 4 occasions, 112 evaluated at 3 occasions, 156 evaluated at 2 occasions).

The questionnaire has 23 items on various aspects of the course; here we focus on the aspects related to the teacher. Based on previous results (Giusti and Varriale 2008) and exploratory regression and factor analyses, we select six items: consistency between homework and number of credits (Q4), course material (Q5), clarity of exam rules (Q7), teacher's availability (Q9), teacher's ability to motivate students (Q10), teacher's clarity of exposition (Q11). Each rating is expressed on a 4-point ordinal scale and converted into an interval scale using the scoring system $\{2,5,7,10\}$. The ratings are then summarized by the average score across students, so that the response variable y_{kti} is the average score of item k at academic year t about course i and the latent variable y^*_{ti} represents student satisfaction with course i at academic year t.

The multi-item LGC model assumes independence across courses at any occasion: this assumption may be questioned since 38% of the professors in the sample taught two or more courses. However, the issue is mitigated by two facts: first, the courses taught by the same professor are usually at different levels (for example, an introductory course and an advanced course), which implies a diversity of content and students, and thus a low correlation; second, a correlation across courses is expected to have little impact on the point estimates and to primarily affect the standard errors. Modelling the correlation across courses would require to add random effects at the teacher level, which is conceptually simple but computationally hard. Overall, it could be argued that the proposed model is suitable for the purpose of this investigation.

We fit the multi-item LGC model defined by equations (1) to (4) via full information maximum likelihood by means of the software Latent Gold (Vermunt and Magidson 2005, 2008) using two different specifications of the longitudinal covariance matrix of the measurement errors, namely the independence structure (*Model IND*) and the compound symmetry structure (*Model CS*) which uses the variance component model (5). Given the identification constraint $\alpha_0 = 0$, the structural part of both models has 5 estimable parameters (1 population slope α_1 and 4 variance-covariance parameters of the latent growth line $\sigma^2_{u_0}, \sigma^2_{u_1}, \sigma_{u_{01}}, \sigma^2_e$). As for the measurement part, given the identification constraint $\lambda_{1k} = 1$ for item Q10, *Model IND* has 17 parameters (6 item intercepts λ_{0k}, 5 item loadings λ_{1k}, 6 residual item variances $\sigma^2_{m,k}$), whereas *Model CS* has 23 parameters (the same item intercepts and loadings plus the between- and within-course residual item variances $\sigma^2_{r,k}$ and $\sigma^2_{s,k}$).

In the first place, the choice between independent and correlated measurement errors should be guided by subject matter considerations. In general, the expression of the longitudinal covariance (7) makes clear that any systematic discrepancy between the observed covariance $cov(y_{kti}, y_{kt'i})$ and the predicted covariance $\lambda^2_{1k} cov(y^*_{ti}, y^*_{t'i})$ is captured by the covariance of the measurement errors $cov(m_{kti}, m_{kt'i})$. In this application there should be no correlation due to the raters since the ratings of distinct academic years are expressed by different sets of students. Anyway, it is conceivable to have a longitudinal correlation of the measurement errors if the performance of some teachers is particularly good or bad with certain items (the reason is that the longitudinal covariance of item k depends on the latent satisfaction of course i through a loading λ_{1k} which is the same for all courses). This kind of discrepancy could be accommodated by a compound symmetry structure because it follows from a variance component model on the measurement errors, $m_{kti} = r_{ki} + s_{kti}$, where the between-course random effect r_{ki} incorporates the unobserved factors specific to item k *and* course i responsible for the good or bad performance. This substantive argument makes the compound symmetry structure (*Model CS*) more plausible than other specifications (such as the lag-1) as an alternative to the independence structure (*Model IND*).

Another criterion for comparing models is based on fit indexes. In this application, *Model CS* is clearly preferred over model *Model IND* on the basis of several standard indexes (for example BIC is 12054 versus 13008). However, for a reasoned choice between the two models it is important to understand which are the specifical aspects improving the global fit and to compare the implications of the two models in terms of the substantive conclusions.

Tables 1 and 2 show the parameter estimates of the two models, which are very close. As for the factor loadings λ_{1k}, in both models the highest values pertain to the items relative to the teaching skills (Q10: teacher's ability to motivate students; Q11: teacher's clarity of exposition). As for the residual item variances, for any item *Model IND* has a single parameter $\sigma^2_{m,k}$, whereas *Model CS* has two parameters corresponding to the between- and within-course decomposition $\sigma^2_{r,k} + \sigma^2_{s,k}$ (the table also shows the between-course proportion, also knows as ICC - Intraclass Correlation Coefficient). The total residual variances of *Model IND* are quite different across items, pointing out that the measurement model is more satisfactory for the three items related to teacher's availability and teaching skills (Q9, Q10, Q11). On the other hand, the high ICC values for all items in *Model CS* signal a relevant longitudinal correlation of the measurement errors.

Table 1 Estimates of the measurement part of multi-item LGC models (*Model IND*: independent measurement errors; *Model CS*: measurement errors with compound symmetry structure)

	Model IND			*Model CS*				
Item	λ_{0k}	λ_{1k}	$\sigma^2_{m,k}$	λ_{0k}	λ_{1k}	$\sigma^2_{r,k}$	$\sigma^2_{s,k}$	ICC
Q4	7.24	0.52	0.81	7.25	0.51	0.47	0.34	0.58
Q5	7.39	0.72	0.47	7.38	0.70	0.23	0.25	0.48
Q7	8.09	0.55	0.53	8.09	0.56	0.18	0.35	0.33
Q9	8.45	0.54	0.29	8.45	0.57	0.13	0.16	0.44
Q10	7.67	1[a]	0.21	7.67	1[a]	0.11	0.10	0.51
Q11	7.74	1.02	0.23	7.74	1.00	0.13	0.11	0.54

[a] fixed value

In terms of the estimates for the latent growth (Table 2), the two models yield nearly identical results. Note that the mean slope is not statistically significant, thus the evaluations of the courses do not appear to have a global trend (this makes sense as the evaluation system was regularly running since several years). However, the variance of the slope among courses $\sigma^2_{u_1}$ is significant, thus the model allows for courses with positive trend as well as course with negative trend.

Table 2 Estimates and standard errors of the structural part of multi-item LGC models (*Model IND*: independent measurement errors; *Model CS*: measurement errors with compound symmetry structure)

Parameter	*Model IND*		*Model CS*	
	Estimate	*SE*	*Estimate*	*SE*
α_0	0^a	-	0^a	-
α_1	0.01	0.02	0.01	0.02
$\sigma^2_{u_0}$	1.00	0.11	0.96	0.12
$\sigma^2_{u_1}$	0.04	0.01	0.04	0.01
$\sigma_{u_{01}}$	-0.06	0.03	-0.06	0.03
σ^2_e	0.24	0.02	0.28	0.03

[a] fixed value

The reasons of the improvement in the global fit of *Model CS* over *Model IND* can be appreciated by inspecting item by item the differences between observed and predicted longitudinal variances-covariances. Predicted values have been obtained by applying formulae (6) and (7). Table 3 reports for each item the mean of absolute relative errors for the 4 variances and for the 6 covariances, along with the fraction of positive errors (observed values higher than predicted values).

Table 3 Observed versus predicted variances and covariances (mean of absolute relative errors and fraction of positive errors) of multi-item LGC models (*Model IND*: independent measurement errors; *Model CS*: measurement errors with compound symmetry structure)

Item	*Model IND*				*Model CS*			
	Variances		*Covariances*		*Variances*		*Covariances*	
	Rel. err.	*Pos. err.*	*Rel. err.*	*Pos. err.*	*Rel. err.*	*Pos. err.*	*Rel. err.*	*Pos. err.*
Q4	0.07	2/4	0.64	6/6	0.07	2/4	0.10	1/6
Q5	0.07	1/4	0.32	6/6	0.06	3/4	0.10	3/6
Q7	0.08	2/4	0.34	6/6	0.09	1/4	0.16	2/6
Q9	0.02	2/4	0.29	6/6	0.04	1/4	0.11	1/6
Q10	0.05	2/4	0.09	4/6	0.05	1/4	0.10	1/6
Q11	0.05	2/4	0.10	6/6	0.05	2/4	0.07	4/6

The variances are well predicted by both models, while there are major differences in the covariances. Indeed, *Model IND* yields good predictions for the covariances of the two items with high factor loadings (Q10 and Q11), whereas it largely underestimates the covariances of the other items. On the contrary, *Model CS* produces predicted values close to observed values for any item (with a slight tendency to overestimation).

To summarize, in this application the two competing specifications of the longitudinal covariance matrix of the measurement errors (independence versus compound symmetry) yield nearly identical estimates of the latent growth curve but remarkably different fits. The specification with compound symmetry seems preferable in this case study since it has a substantive justification, yields a better fit and gives further insights into the phenomenon of interest without disadvantages in terms of interpretability.

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An Application of Text Mining Technique for the Census of Nonprofit Institutions

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Abstract. The National Institutes of Statistics are increasing in the use of administrative data, which are routinely collected by organizations as part of their business or operational activities. As a matter of fact, this huge amount of data is relevant whether by transforming in statistics for building information systems or by using them as additional information during the whole statistical survey. With regards to Italian nonprofit institutions' Census, text data from the Italian Revenue Agency are being used to create the list. The paper explores the opportunity of using the text mining technique on the available data to build a classification of nonprofit organizations, which may also help to distinguish them from firms and public institutions. Finally, this paper explains the application of text mining during the whole process and highlights advantages and disadvantages of the above-mentioned text mining technique

Keywords: Text mining, Nonprofit Institutions Census, Administrative data

1 Introduction

General Censuses of Industry and Services were carried out in 1981, 1991 and 2001. Istat has been surveying nonprofit organizations as well as firms and public institutions. With regards to nonprofit sector, one of the most critical aspects in the Census is the level of coverage due to the lack of comprehensive and base archive for nonprofit

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institutions (NPI). In fact, the identification of NPI is not an easy task, due to the lack of legal framework, as well as a no clear and general definition of nonprofit institutions into the Italian law. Furthermore, NPIs are often informal organizations. Nevertheless, there are different sectorial archives of nonprofit institutions (Voluntary Organizations and Social Cooperatives Registry, EAS, 5 per mille, Onlus, etc.), but these registries do not cover the population of NPIs. Since 1999 Istat has consulted the Italian fiscal register (by Agenzia dell'Entrate) no considering firms and public institutions in order to ensure high level of coverage. In the context of the Census it is essential to identify nonprofit institutions within units (over 3 million) registered into the fiscal archive differentiated by legal profiles both public and profit organizations. Although the fiscal registry classifies the units by legal framework and economic sectors, the recognition of nonprofit status is not prompt. Indeed, some preliminary analyses have shown that the fiscal registry classification by legal status and economic sector may be biased. After all, administrative data do not often satisfy the objectives and the criteria of the statistical surveys.

2 Text mining and text categorization

With regards to the nonprofit institutions identification, it is useful to consider the organization name recorded into the fiscal registry. Furthermore, it is possible to classify INP by institutional typology[1] capturing the semantic meaning of the corporate denomination.

To analyse the content of organization's name, it is necessary to apply text mining techniques. According to the literature, text mining implies a wide range of methods used to select the targeted information in large number of documents and it automatically identifies interesting patterns and relations in textual data [1]. In details, the content analysis of fiscal registry unit name could be considered as case in point of text classification. Starting from a textual document set and a taxonomy, the overall objective of text categorization is a process to identify the proper category for each document. In practice, the aim is to find a function M: D x C → {0,1}, called classifier, where D is a set of disordered textual data and C represents a set of the categories of a taxonomy. The M function has to be formulated so as its behavior is as closer as possible to the true (but unknown) assignment function of textual document to the appropriate category.

Generally speaking, text classification techniques could be divided into two main branches. The first is the knowledge engineering approach which focuses on manual development of classification rules. A sectorial expert identifies a set of sufficient conditions for a document to be categorized into a given category. For each category the classification process consists of logical rules showed as follows: ***if DFN** formula* ***then** category=*c_i. The system DNF (disjunction of conjunctive clauses) is simply a list of logical clauses, therefore, if a document satisfies a specific condition, that is classified into the related category [4].

On the other hand, the machine learning (ML) approach whereby the classifier is built automatically by learning category properties from a set of pre-classified examples. In

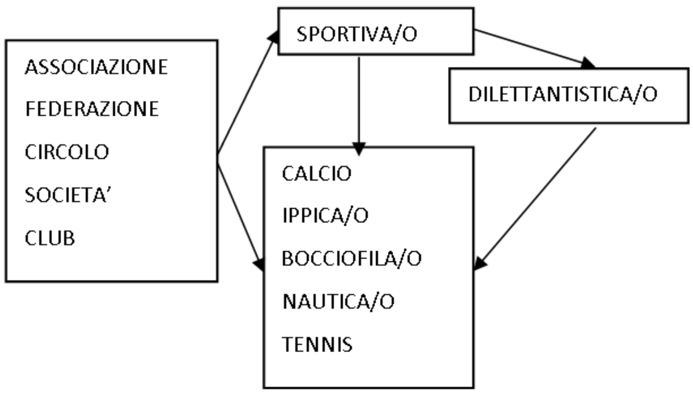
[1] Institutional typology is a taxonomy that combines together the legal form with the economic sector. This taxonomy is not used for heuristic scope but to facilitate several phase of the statistical production process.

the ML approach, there are many techniques to build the classifier learning; some of them are based on probabilistic theory or decision tree [5], and others use neural network algorithms [6].
While the main disadvantage of knowledge engineering approach is the huge amount of time and expert knowledge required, machine learning approach is much less costly to implement but generally it does not reach the performance in comparison to the other one [2].

3 An automatic classification of the organization's name

To classify the different units from both firms and public institutions, recorded in the fiscal registry, we adopted the knowledge engineering approach. This problem is developed as research of "target entity" (in this case, considering different categories of nonprofit institutions) that is scattered inside a collection of texts. [1].
The classification rules have been written by analyzing the dictionary of organizational framework (association, group, center, club, etc.) and attributes of nonprofit institutions according to the *local grammar* shown in the figure below:

Figure 1: research of the textual entity 'associazione sportiva'



Back to back mild pre-treatment of the corpus removing the stop words (mainly articles and preposition), the phase of identifying the specific dictionary and recurrent segments for each category of the institutional typology is needed. To this purpose, the software Lexico 3 was used as training to set the organizations' names in 1999 Census.
The automatic classification program related to the organization's name was written in SAS as character functions of this software (*scan*, *substr* and *find*) in order to locate categories' distinctive attributes into a text string. In this way, the position of the words is deeply related to the assignment of an organization and the fitting category.

The program, more than 1.000 classification rules, was tested on the dataset of 435 thousand units recorded in the fiscal registry, presenting theoretically a legal framework consistent with the status of nonprofit institution[1].
Altogether, this procedure has produced good results classifying about 75% of units; in addition, about 50% of classified records have been recognized as 'association' coherently with the distribution of Italian nonprofit institutions differentiated by legal framework. Lastly, about 30% of organizations do not match the criteria of nonprofit institutions (firms, public institutions, condominium, etc.).
To assess in depth the performance of the adopted procedure was important to compute two measures: *recall* errors and *precision* errors[2]. For this purpose, a set of 450 units were casually sampled from the original dataset. Hence, 60,4% and 79,1% are respectively recall and precision errors and 68,5% is the combined indicator for the above-mentioned errors

4 Conclusion

Text mining technique opens a new scenario for the treatment of textual documents registered in the administrative archives. The implemented procedure for the automatic classification of organization's name has worked effectively. Actually, knowledge engineering is labour intensive but in the same time it may ensure more precision and control over the classification process as a whole. However, it is relevant to empirically verify the advantages of different approaches.

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[1] The number of total words is equal to 1.719.774 while the number of graphical forms is 45413. The percentage of hapax is around 35,1%.

[2] The precision error occurs when a document is not assigned to the pertinent category by the classifier while recall error happens when a category does not include documents that should belong to it. The first type of error is measured as the percentage of correctly classified documents among those attributes to the category and the latter is defined as the percentage of correctly classified documents among all those belonging to that category.

Record Linkage Between Italian Administrative Sources and Sample Surveys - How Much Information We Can Get? Three case studies.

Francesca Lariccia, Eleonora Mussino, Antonella Pinnelli, Sabrina Prati, Francesca Rinesi and Salvatore Strozza

Abstract In the last decades a renewed attention has been given to data integration methods. The present paper illustrates three possible applications of record linkage procedures to demographic data using both sample survey and administrative data. Two of the three case studies presented aim to reconstruct the reproductive behaviour of women in Italy, while the third study illustrates the relationship between socio-demographic variables and medical and health aspects related to pregnancy and delivery.

1 Introduction and aim of the paper

The aim of Record Linkage is to join information referred to the same individual but stored in multiple datasets. Similarly to other data integration techniques, record linkage let a better exploitation of existing data by reducing both the respondent burden and the costs associated with the implementation of a new survey (Winkler, 2005).

Record Linkage techniques are commonly used in several disciplines (such as biology, economics, medical research, …) and performed by combining information gathered in two or more datasets that refer to the entire population or by linking survey data with an exhaustive source. At the same time multiple goals can be achieved by using data integration techniques. The most common of those are: duplicate record

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detection, building longitudinal datasets, validate new variables, study the relationship between variables collected in different datasets, and estimate the unknown size of a population. Finally, both deterministic and probabilistic approach can be used.

The present paper seeks to highlight this complexity by illustrating the goals and the main results of three different case studies that refers to Italy. All of these studies share: (1) the field of application (that is demography); (2) the originality of the studies since none of the corresponding research questions could be answered by using available (non-linked) data; (3) one of the data source used to perform the linkage procedures (the Survey on Live Births).

2 Data

In the case studies presented several data source have been exploited and linked. The Survey on Live Births can be considered as the leading one since it is used in all the three studies. The individual form used to register every live-birth delivered by the Resident Population includes several information on births (newborn's name and surname, sex, date and place of birth, and citizenship), parents (name, surname, date of birth, citizenship, and marital status) and the main details of the head of the household.

The other sources involved are:

- The Sample Survey on Births (first and second edition) has been run by Istat in 2003 and in 2005 by interviewing 50,000 women that have had a child 18-21 month before the interview. A great number of aspects related with motherhood are considered, ranging from demographic and social characteristics, to delivery, child caring and household economic situation (Istat, 2006).
- The Register of Residence Permits represents the main source on the legal presence of foreigners in Italy. This data are collected by the Ministry of Interior and processed and released by ISTAT. The register includes information on the demographic (sex, age, civil status, citizenship) and on the migration (date of arrival, duration, and reason for permit) characteristics of the present foreign population in Italy (Egidi and Ferruzza, 2010).
- The Certificates of Healthcare at Delivery (CeDAPs) have been set up in 2002 by the Ministry of Health and are a thorough mapping of births, deliveries and perinatal outcomes of all those women who have given birth in Italy (Ministero della Salute, 2004). The data form contains medical and health information on pregnancy, delivery, and newborn, as well as information on the social and demographic characteristics of the parents.

3 Main findings

3.1 Case study A

The focus of this research is the study of the transition to second and third child among women who live in Italy. More precisely, our aim was to highlight which individual socio-demographic and economic characteristics favour or discourage the birth of an additional child. Special attention was given to the role of fertility plans stated by women at interview in predicting subsequent reproductive behaviour. By using deterministic record linkage procedures an ad-hoc longitudinal dataset was built by linking the first edition of the Sample Survey on Births and the list of all live births (Survey on Live Births) registered in Population Register during the period 2002-2008. The matching key used is mothers' name, surname and date of birth. As indictor of record linkage quality we computed the share of births registered in the Population Register in the nine months following the interview by women stating they were pregnant at interview time and we found that there was a high correspondence (81%). Note around 8% of births recorded in the Population Register do not list the mothers' information. The result of the record linkage procedure was the building of a longitudinal dataset of the reproductive behaviour of all mothers interviewed. Therefore the this procedure made possible to compensate to the lack of genuine longitudinal data on this topic. The strong point of this new data source is that it can be further updated by adding year by year the new births delivered by women interviewed in 2002, up to the end of their fertile age. Finally, the ad-hoc dataset created it land itself to event history analysis as well as to the compute of cohort indicators.

3.2 Case study B

The focus of the present research is the analyse of the over medicalization of birth in Italy. More precisely, we aim to assess which contextual and individual factors encourage this phenomenon, by considering the socio-demographic characteristics of the mothers, as well as medical and health aspects related to pregnancy, delivery, and newborn. In order to have a national sample dataset including all this information, we have linked the Certificates of Healthcare at Delivery (CeDAPs) relative to 2003 with the second edition of the Sample Survey on Births by means of deterministic record linkage techniques. To ensure an optimal quality of results, the record linkage procedure was carried out in two phases: firstly, the CEDAPs of 2003 were linked with the list of all live births registered in Population Register during 2003, this latter representing the universe from which the sample of the Sample Survey on Births is taken; in the second phase the outcome was linked with the Sample Survey on Births. The matching variables used in the first phase were the mothers' place of residence and date of birth, and the baby's place of birth and date of birth. Since in the two surveys the same population is considered (i.e. live-birth in Italy delivered by the Resident Population), the percentage of matched records (74%) was used as an indicator of quality of record linkage results.

The ad hoc dataset obtained has allowed a more complete analysis of the birth phenomenon in Italy: for example, we were able to compare the variability and appropriateness of the use of caesarean section in the Italian regions by means of the "Robson classification", which provides a standard framework for monitoring, auditing and analysing the caesarean section rate. Moreover, the Record Linkage procedure has allowed us to control the quality of the information collected with the CeDAPs by validating and correcting selected variables. Finally, note that the new data source can be produced regularly.

3.3 Case study C

The purpose of this research was to study the reproductive behaviours of foreign women who live in Italy using a longitudinal approach. In order to do so the linkage between the Survey on Live Births and the Register of Residence Permits for the period 2002-2006 had been performed. In the first step we identify, using deterministic procedures, the reproductive history of women that have at least a child in the period considered. In this way we acquired information about mothers and their children; in a previous paper (Mussino et al., 2010) we defined the new dataset as Reproductive History Dataset (RHD). The second step focuses on mothers that have their first child birth in Italy and recorded in 2003: for these women we looked to their migration history by using the Register of Residence Permits. In this step we focus on the women from Albania, Romania and Morocco: these mothers should be registered in both the two data source but for administrative reasons this is not always the case, although the proportion of links is high (86.6%). Due to the lack of other discriminating variables we approached the problem using probabilistic procedures. The matching variables that we used were the mother's name and surname (without vocals), date of birth, and citizenship. The latter is used to reduce a priori the dataset so it is not inserted in the model to compare the pairs in the comparison space. The procedure ended by linking the residuals with the Jaro-Winkler function and considering the resident permits from 2002 to 2004. The distance between the distribution of the comparison vectors in the set of matches and the corresponding distribution in the set of non-matches is large and the area where they overlap is small. This indicates that a high quality of results is achieved. The creation of this longitudinal dataset allowed us to study the reproductive behavior of foreign mothers for the period 2002–2006. Additionally, the introduction of the migratory experiences made the study of the interrelation between migration and fertility careers possible.

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Il “libro della Patria”: l’Annuario Statistico Italiano

Vincenzo Lo Moro[1] and Barbara Fiocco[2]

Abstract: In this paper, the analysis of the Italian Statistical Yearbook - the most important and oldest publication of official statistics – allows to reconstruct not only the history of official statistics, but also, to some extent, the history of the country. The method used is the “content analysis”, carried out through two tests, one for the detection of the formal characteristics and structural content of the volumes and the other for the detection of characteristics of presentations. The analysis allows to understand successes, difficulties, shifts in focus, changing styles, new targets…in a nutshell, as the official statistics has dealt with the historical events.

Key Words: Italian Statistical Yearbook, Official Statistics, Content Analysis

1 Introduzione

Per l’esame dei volumi dell’Annuario statistico italiano, dal 1878 al 2010, si è fatto ricorso all’analisi del contenuto, una procedura ampiamente utilizzata nella ricerca sociale già a partire dagli anni ’30, che si avvale della scomposizione dei testi, al fine di codificarli e classificarli, costruendo dati da inserire in una matrice e da sottoporre all’analisi statistica[3]. Sono state messe a punto due schede d’analisi: una per la rilevazione delle caratteristiche formali/strutturali e dei contenuti dei volumi nel loro complesso[4], l’altra per la rilevazione delle caratteristiche delle presentazioni dell’Annuario[5]. Il presente lavoro è tratto da Fiocco B. (2009).

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[4] 65 voci in tre sezioni: informazioni generali, caratteristiche strutturali, contenuti dei volumi.
[5] 20 voci in tre sezioni: informazioni generali, funzione e stile, contenuti delle presentazioni.

2 Le caratteristiche strutturali

Lo *scarto temporale* fra l'anno al quale è intestato il volume e l'anno di pubblicazione fornisce una prima indicazione di quali siano stati i momenti di difficoltà vissuti dal Paese e/o dall'ente produttore di statistica, difficoltà che hanno evidentemente avuto inevitabili ripercussioni sui tempi di compilazione dell'Annuario che, nei periodi più "scuri", è stato anche dato alle stampe in edizione pluriennale.
Quanto al *numero di pagine* (escludendo i volumi doppi) esse variano tra le 1000 e le 300. Nei periodi di crisi il numero di pagine date alle stampe è stato drasticamente esiguo: il "problema della carta", l'interruzione di alcune rilevazioni durante la guerra, la non opportunità di diffondere certe informazioni, nonché la proibizione a pubblicarne altre a causa delle sanzioni, hanno notevolmente ridotto l'ampiezza dei volumi.
Il difficile reperimento delle informazioni e alcune "imperiose necessità tipografiche" (1878)[6] finalizzate a far rispettare, per quanto possibile, la periodicità della pubblicazione, hanno giocato un ruolo molto importante nel determinare l'*ordine* con il quale, soprattutto nei primi anni, le materie sono state presentate all'interno dell'Annuario; in sostanza l'intreccio tra tempestività dei dati ed esigenze tipografiche aveva come conseguenza che "l'ordine in cui si succedono le materie non è sempre il più razionale" (1878). Di qui l'esigenza di introdurre nel volume un indice analitico-alfabetico per una più agevole consultazione delle materie, inserito a partire dal secondo volume della prima serie, assente in 22 volumi nel '900 e ricomparso definitivamente dal 1997. Da allora in poi, indici, glossari, note metodologiche e rimandi si affinano sempre di più.
Se, come è naturale in una pubblicazione statistica, le tabelle sono presenti in tutti i volumi, i commenti ai dati sono stati rilevati soltanto nei primi (dal 1878 al 1900, con l'esclusione delle edizioni del 1897 e del 1898) e nei volumi dal 1985 ad oggi, dove diventano sempre più estesi; per tutti gli altri si è preferito adottare una forma editoriale "esclusivamente tabellare".

3 Le presentazioni

La tipologia di presentazione più frequentemente utilizzata è stata la *lettera* a cura del Direttore e, successivamente, del Presidente dell'ente produttore di statistica ufficiale.
Una evoluzione interessante si può rilevare dall'indicazione dei *destinatari* delle pubblicazione, che risulta esplicitamente presente in 33 volumi degli 94 volumi che contengono una presentazione. Al di là del destinatario istituzionale delle lettere, i primi Annuari sono 'indirizzati' a un generico "lettore benevolo" che, come meglio indicato nell'edizione 1881, è uno studioso e non poteva essere altrimenti in un Paese nel quale l'analfabetismo si attestava intorno al 73%, secondo quanto riportato nell'introduzione dello stesso Annuario. Agli studiosi quali 'unici' destinatari della pubblicazione, si affiancano successivamente la pubblica amministrazione, il Governo, gli uomini d'affari e le persone colte (periodo tra le due guerre). Con il trascorrere degli

[6] Qui e in seguito l'anno tra parentesi indica l'Annuario da cui è tratta la citazione

anni l’informazione statistica si è aperta a un «pubblico più ampio» (1998), anche di non specialisti, e così l’Annuario ha cominciato ad essere indirizzato a «quanti [a vario titolo] si occupano di statistica» (1934), a «tutti coloro che dalle cifre, aride solo in apparenza, sanno riconoscere come pulsi fervida la vita nazionale» (1932-1933), e ha finito con il rivolgersi, in tempi recenti, alla generica categoria “utenti” (dal 2002 in poi), nella quale, oltre alle imprese e alle istituzioni, rientrano anche le famiglie.
L’attenzione alla *qualità* ha una evoluzione singolare. Ciò che interessa, inizialmente, in maniera pressoché esclusiva, è la freschezza dei dati anche a scapito del “sincronismo”. Successivamente comincia ad assumere importanza la correttezza, la fedeltà del dato che, prima di essere inviato alle stampe, viene sempre più accertato, controllato, perfezionato, tanto che l’“errata corrige”, che era risultata pressoché costantemente presente fino all’edizione 1965, scompare dalla pubblicazione. Assumono, poi, importanza la completezza dei dati e, la loro affidabilità e infine la comparabilità, anche a livello internazionale. In sostanza si affermano i principi ispiratori della statistica internazionale, prima ancora delle loro codificazioni formali.
Le *formule di apertura e chiusura* e l’uso del Voi o del Lei nelle lettere di presentazione rappresentano una nota di costume particolarmente interessante durante il periodo fascista. Il vocativo “Eccellenza” apre frequentemente le presentazioni dei volumi tra le due guerre, ma cambia la forma grafica: con la sola lettera iniziale maiuscola nell’Annuario 1917-1918, in maiuscoletto nell’edizione 1922-25 (ECCELLENZA), in maiuscolo nelle edizioni dal 1927 al 1930 (ECCELLENZA), per poi tornare in maiuscoletto, dal 1931 al 1937. Peraltro, negli Annuari dal 1927 al 1930 la dimensione del carattere della parola è grande, più o meno, il doppio rispetto all’edizione 1922-1925. Si tratta del periodo di grande assonanza tra Gini e il Duce.
Ancora, le presentazioni consentono di individuare degli *spaccati della vita* del Paese: nel 1912 una digressione in difesa della misura del *caro viveri*, non molto dissimile dalle ricorrenti polemiche sul costo della vita; l’attenzione all’esercito nel 1914 e l’esplicita definizione di Aschieri dell’Annuario 1917/1918, come “annuario di guerra”; l’attenzione ai territori annessi, subito dopo la fine del conflitto; l’auspicio della ripresa economica, “ascensione materiale e morale”, sempre in quegli anni.

4 I contenuti

Ci sono argomenti presenti praticamente in tutti gli Annuari. Gli *argomenti* sui quali ci si soffermerà sono, viceversa, quelli risultati presenti in certi momenti storici e quelli che hanno fatto la loro comparsa a partire da un certo periodo.
Nei primi volumi dell’Annuario, fino all’edizione 1932, un argomento costantemente presente è relativo all’Asse Ecclesiastico, ne quale si documenta come l’alienazione dei beni ecclesiastici diede risultati molto deludenti rispetto alle previsioni.
Un altro argomento che è risultato presente nell’Annuario in due diversi momenti storici è quello dei “Possessi coloniali”. L’Annuario ha registrato fedelmente la politica espansionistica attuata dall’Italia durante il ventennio fascista, ma ha anche rilevato le imprese coloniali italiane alla fine dell’Ottocento.
Lo Stato corporativo - il regime di collaborazione di classe e di conciliazione giuridica fra lavoratori e datori di lavoro - ha significativi riscontri negli Annuari. Scompare il

capitolo “Scioperi”, un “non senso” secondo la Carta del Lavoro varata nel 1927 e compare l’argomento “Corporazioni”, fino al 1943.
Dopo la guerra si affermarono nuove preoccupazioni economiche e sociali e, di conseguenza, nuove politiche per cercare di regolarle. Apertura al mercato europeo, stabilizzazione monetaria, controllo della dinamica dei grandi aggregati (prodotto lordo, consumi, investimenti, spesa pubblica), ricostruzione, lotta alla disoccupazione e agli squilibri territoriali, definirono la nuova agenda delle questioni che domandava nuovi strumenti e, ancor prima, un linguaggio statistico nuovo.
Se, dunque, il primo asse portante della ricostruzione è l’introduzione dei conti economici nazionali, «il secondo asse portante sta nell’introduzione di grandi indagini campionarie su scala nazionale, progettate e condotte correntemente in prima persona dall’Istat con il supporto di enti periferici: i Comuni e le Camere di Commercio»[7]. La prima indagine campionaria condotta dall’Istat fu quella sulle forze di lavoro, i cui risultati provvisori furono pubblicati sull’Annuario 1952. All’indagine del 1952 ne seguirono altre con cadenza non proprio sistematica; solo a partire dal 1959 l’indagine assunse una cadenza trimestrale.

5 Conclusioni

L’analisi dell’Annuario ha mostrato un’Italia che, subito dopo l’unificazione, si trovava in una situazione economica disastrosa, ma non per questo rinunciava alla sue mire espansionistiche; che dopo il primo conflitto mondiale è crollata in un regime totalitario nel quale le statistiche ufficiali sono state ‘piegate’ alle esigenze di nazionalizzazione delle masse, richieste dal regime stesso. Un’Italia che, dopo essersi ripresa dalla II guerra mondiale, non si interessa soltanto alle dinamiche economiche, ma comincia anche a prestare attenzione alla sua dimensione sociale.
Concludendo si può affermare che, in questi anni, l’Annuario è venuto incontro ai desideri del suo fondatore che, a cinque anni dall’uscita del primo volume ufficiale, così si esprimeva: «…gli Italiani avranno un libro, al quale poco mancherà perché possa chiamarsi col dolce e glorioso nome di libro della patria»[8].

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Statistical Issues in the Life Sciences Industry: Definition, Data Sources and Industrial Classifications

Silvia Lombardi, Valeria Tomeo

Abstract The Life Sciences industry has a composite industrial structure, which comprises a set of high technology-driven sub-sectors interlinked among each other. Within international scientific community, it is widely acknowledged that biotechnology, pharmaceutical and medical technology industries compose the Life Sciences industry. Despite the relevance that Life Sciences industry has acquired for its economic impact over the last decades, the lack of an official and shared statistical definition of Life Sciences does not allow for the provision of harmonized and aligned statistics at the international level. The primary issue is the difficulty to construct homogeneous databases on Life Sciences across different countries by referring to available standard classifications on activities and their different versions. The aim of the paper is to provide a complete review at the international level of statistical data sources in the Life Sciences, and highlight existing activities classifications applied for its statistical identification. Distortions and inconsistencies will be considered as starting points for a broader reflection on prospects for Life Sciences definition and classification.

Keywords: Life Sciences statistics, Biotechnology, Pharmaceutical, Medical technology.

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1 The Life Sciences industry and the current classification scenario

The Life Sciences (LS) industry has a composite industrial structure, which is acknowledged to comprise technology-driven industrial sub-sets as biotechnology, pharmaceuticals and medical technology. In the absence of a uniform and shared basic definition, LS is commonly derived from the union of the following definitions:

- Biotechnology, whose definition varies greatly according to countries and industry surveys. Some of them are based on a wide and single definition of biotech, which encompasses a composite set of biotech activities; others, by contrast, are based on a multiple definition, which identifies specific classes and typologies of biotech activities and includes inductively general ones [2]. OECD (2005 and 2009) provides an accurate statistical framework in order to promote harmonized measurement among OECD countries and identify both modern biotech activities as well as more traditional ones;
- the definition of medical technology is "*any technology used to save lives in individuals suffering from a wide range of conditions. In its many forms, medical technology is already diagnosing, monitoring and treating virtually every disease or condition that affects us. Medical technology can be familiar, everyday objects such as sticking plasters, syringes or latex gloves. Alternatively, it could also be spectacles, wheelchairs and hearing aids. Meanwhile, at the high tech end of the scale, medical technology includes total body scanners, implantable devices such as heart valves and pacemakers, and replacement joints for knees and hips*" [5]. However, it is commonly used interchangeably with 'medical devices', being the latter defined by the European Commission in the 'EU Medical Devices' Directive 2007/47/EC'.
- Pharmaceutical industry includes firms "*engaged in the discovery, manufacturing, and marketing of legal drugs, biologics (viruses, toxins, serums, and analogous products), vaccines, and medical devices*" [6].

Remarkably, the simple summation of separate basic definitions brings about inaccuracy given the intersection of industrial sub-sets (i.e. medical devices within pharmaceutical industry).

LS lack an official statistical definition, which is reflected in the absence of a uniform classification of LS activities within the international statistical classifications of economic activities. Therefore, separate statistical definitions derived by several official sources need to be applied in order to draw the analysis of LS at international level. However, even the use of definitions of industrial sub-sets has some definition deficiencies. For instance, in the case of biotechnology, although it is a composition of many manufacturing, R&D and services industries, only R&D activities are classified [1].

International scenario of statistical classification shows many limits and issues. The multiplicity of actors shaping economic relations of LS industry encompasses the

private sector, public and private founded research centers, financial institutions, industrial parks, and, last but not least, government agencies and public bodies, as well as their interactions on an international scale. In addition, LS industrial sub-sets are strictly intertwined among each other. Therefore, conceptually, LS should be referred to as an *industry*, composed, at its core, of interlinking functional production linkages. From a statistical point of view, the lack of both a definition of LS and a classification of its economic activities does not allow to take into account the industrial nature of LS, bringing about two orders of consequences. Firstly, a pure definition order. LS is under-appraised due to the arbitrary choice not to involve medical technology as a whole, hence computing only medical devices (i.e. UK Department for Business Enterprise and Regulatory Reform computes only medical devices within LS). Secondly, a classification order. The utilization of classifications of economic activities of separate industrial sub-sets leads to overlapping economic activities related to more than a industrial sub-set (i.e. the NACE 21.20 "Manufacture of pharmaceutical preparations" includes also, for instance, the manufacture of medical diagnostic preparations or radioactive in-vivo diagnostic substances which are classified as medical devices according to the normative definition European Commission in the 'EU Medical Devices' Directive 2007/47/EC). In addition, EU and international classifications are utilized in their several revisions by economic organizations, associations, and other research bodies. Therefore, currently available data on separate industrial sub-sets may be referred to different revisions, which are not always comparable in time, and time series are not constructible for the whole LS industry.
Hence, despite reliable and comparable statistics are used, the LS industry does not ends up not having statistically accuracy.

2 Towards a proposal for LS statistical classification

The complete international survey of statistical data sources in the LS highlights existing activities and products classifications applied for its statistical identification. The framework perimeter of the following methodology is the economic activity. Since products are a result of such economic activities, and their intrinsic high tech nature may leads to changes of classification due to technological shifts, products may bring about a loss of framework perimeter.
The present work utilizes three criteria as the methodological basis in order to propose a uniform classification of LS economic activities [4] (1) *Prevalence*: products related to a specific economic activity are attributed to the industrial sub-set mainly using them without loss of generality. (2) *Exclusivity*: each economic activity is taken into account once (3) *Contamination*: the use of a supra-national classification brings about a more generalist approach since it cannot considers lower hierarchical levels.
Given the definition and classification orders of issues described above, and the use of different EU and international classifications and their revisions, we harmonized primary sources to NACE Rev. 2 (4 digits). The following Table 1 summarizes classifications of economic activities utilized in international studies conducted on LS and its industrial sub-sets, aggregated on the basis of above mentioned criteria.
Economic organizations, associations, other research bodies producing LS reports and utilizing LS data (listed in the right hand column) have been also attributed B, MD,

MT, P according to the attribution of each NACE Rev. 2 class to biotechnology, medical devices, medical technology or pharmaceutical industry. It is noteworthy class NACE 21.20 which is attributed both to pharmaceutical and medical devices.

Table 1. Proposed classification of Life Sciences

LIFE SCIENCES INDUSTRY, NACE Rev. 2				Economic organizations, associations, other research bodies
DIVISION	*GROUP*	*CLASS*		
21	21.1	21.10	Manufacture of basic pharmaceutical products	OECD (P), ECO[1] (P), Farmindustria (P), EFPIA[2](P), UK BERR[3](P)
21	21.2	21.20	Manufacture of pharmaceutical preparations	OECD (P), ECO (P), Farmindustria(P), EFPIA (P), UK BERR (P, MD)
26	26.6	26.60	Manufacture of irradiation, electromedical and electrotherapeutic equipment	ECO (MD), Eucomed (MT), US OHC[4](MD), Osservatorio Biomedicale Veneto (MT)
30	30.9	30.92	Manufacture of bicycles and invalid carriages	Osservatorio Biomedicale Veneto (MT)
32	32.5	32.50	Manufacture of medical and dental instruments and supplies	OECD (MD), ECO (MD), Eucomed (MT), US OHC (MD), UK BERR (MD), Osservatorio Biomedicale Veneto (MT)
72	72.1	72.11	Research and experimental development on biotechnology	OECD (B), ECO (B), US OHC (B)

Note: (1) European Cluster Observatory; (2) European Federation of Pharmaceutical Industries and Associations; (3) UK Department for Business Enterprise and Regulatory Reform; (4) US Office of Health and Consumers Goods.
B: Biotechnology; MD: Medical Device; MT: Medical Technology; P: Pharmaceutical.

Conclusion

The conception of LS as an industry brings about definition and classification issues. The adjustment of international European classifications carried out so far, as the introduction of the NACE Rev 2. classification related to biotechnology R&D is a first step in this sense. However, it is necessary to step forward and provide harmonized uniform classification of LS. At the moment, the proposed solution is a uniform classification, which overcomes overlapping problems and under-appraisal.

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diffusione di Internet nelle imprese, la formazione, la rete nei centri di ricerca. Un primo bilancio del benchmark regionale della società dell´informazione.
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6. http://www.eucomed.org/medical-technology

The Alien Character of Local Economies: Micro-Entrepreneurship inside the Origin-Destination Matrix

Franco Lorenzini, Fabio Sforzi and Flavio Verrecchia

Abstract. Since the late 1970s, scholars have paid increasingly attention to micro-entrepreneurship in Italy, together with the acknowledgment of Industrial Districts as a primary theoretic and empirical approach to local industrial development. Industrial Districts approach has explained the dependence of micro-entrepreneurship on the industrial atmosphere of a place. However, little attention has been paid on the origin of micro-entrepreneurs, and to what extent they are natives or foreigners, who have migrated in the place and have set up their economic activities. Data collected in ASIA-ISTAT archives overcome such lack of information. The aim of this paper is to investigate the structure of local micro-entrepreneurship in order to analyse (a) the extent of its natives/migrants entrepreneurs composition, and (b) which Italian regions and foreign countries such micro-entrepreneurs come from. The study uses an origin-destination matrix, which connects place of birth of micro-entrepreneurs and the place of localization of their firms. Places are defined on the basis of ISTAT Local Manufacturing Market Areas (LLMAs).

Keywords: Micro-Entrepreneurship, Origin-Destination Matrix, LLMA.

Introduction and methods

The local structures of micro-entrepreneurship in terms of natives/migrants micro-entrepreneurs composition is the subject of the paper. Places where micro-entrepreneurs have set up their economic activities are defined as Local Labour Market Areas (LLMAs)

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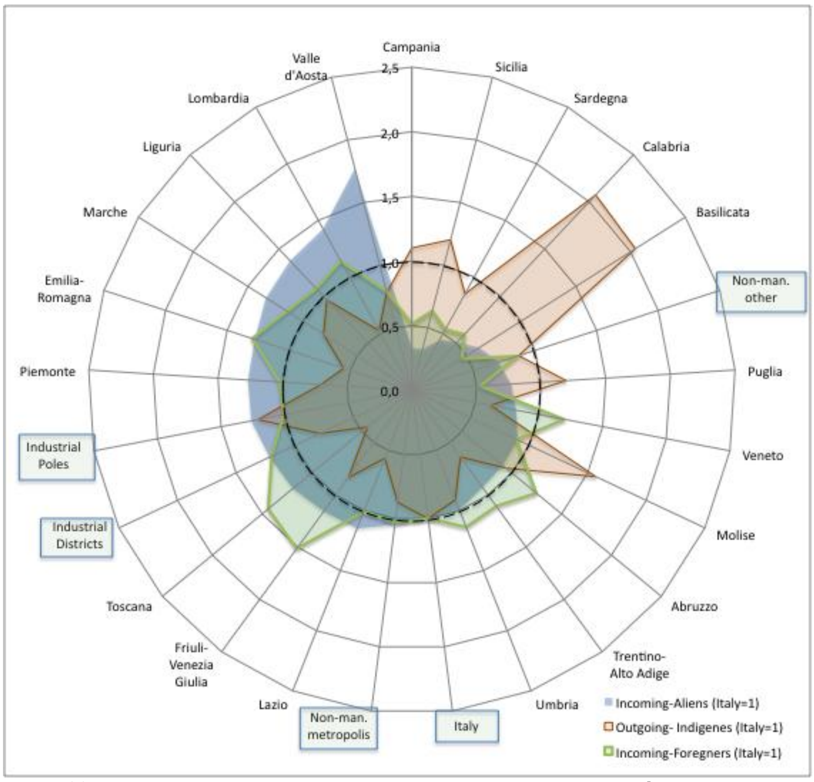
[2]. The analysis of entrepreneurs' characters is particularly relevant with respect to the topic of industrial districts (IDs) because of the importance of intertwined social relations rather than business relations [3]. This paper, that aims to study the origin (by birth place of micro-entrepreneurs[1]) and the destination (by localization) of the national actives entrepreneurs[2], considers as statistical unit the micro-entrepreneur as according to the EU definition[3], excluding the partnerships legal form.

Applications: *Stars* and *Saint Lucy eye* draw the typologies

The traits of Regions (NUTS2) and LLMAs are defined by two *Stars* and the *eye of Saint Lucy* (Fig. 1). They reflect different proportions of the national intensity of the studied phenomena (i.e. Outgoing Indigenes indices – OIi; Incoming Foreigners indices - IFi; Incoming Aliens indices - IAi), and have to be considered together with the endowments.

Figure 1: Indigenes, Aliens and Foreigners, by Regions and LLMAs, Italy, 2007 (indices,Italy=1)



Notes: (a) Regions NUTS2. **Sources**: Data processing on ISTAT-ASIA archive.

[1] The tax code defines the place of birth.
[2] Existence, location and state of activity of the entrepreneur are defined by ASIA archive.
[3] Self-employment – firm, freelance, (free)professional – with both less than 10 persons employed and with a turnover less than 2 million (entrepreneurs excluded: 0.9%) [4]. Firms considered: 64%.

Without loss of generality, given both the three-ways (i.e. for every LLMA) matrix and the regional origin-destination (O-D) matrix, and the aggregations of interest (i.e. indigenes – natives; aliens – migrants Italians and foreigners), the following equations[1] are applicable: $IAi_i = IA_i / IA$; $IFi_i = IF_i / IF$; $OIi_j = OI_j / OI$. From the study of diagonals and marginal of the O-D matrix, some considerations can be synthesized by utilizing the following typologies of Regions and LLMAs (Tab. 1, 2).

Table 1: Indigenes, Aliens and Foreigners, by Regions, 2007 (indices, Italy = 1)

Regions (NUTS2)	*Incoming Aliens IAi (Italy=1)*	*Outgoing Indigenes OIi (Italy=1)*	*Incoming Foreigners IFi (Italy=1)*	*Typologies*
Campania	0.3	1.1	0.5	Backward and repulsive
Sicilia	0.3	1.2	0.6	
Calabria	0.5	2.1	0.6	
Basilicata	0.6	2.0	0.5	
Puglia	0.8	1.2	0.5	
Molise	0.9	1.6	0.9	
Sardegna	0.4	0.9	0.5	Close
Veneto	0.8	0.6	1.2	Close but xenophilous
Abruzzo	0.9	0.9	1.2	
Trentino-Alto Adige	0.9	0.6	1.1	
Umbria	1.0	0.9	1.1	
Italy	***1.0***	***1.0***	***1.0***	*Middling*
Lazio	1.1	0.6	1.0	Open
Piemonte	1.3	0.7	1.0	
Valle d'Aosta	1.8	0.8	0.8	
Friuli-Venezia Giulia	1.2	0.8	1.5	Open and xenophilous
Toscana	1.2	0.4	1.4	
Emilia-Romagna	1.3	0.6	1.3	
Marche	1.3	0.8	1.1	
Liguria	1.4	1.0	1.1	
Lombardia	1.4	0.5	1.1	

Sources: Data processing on ISTAT-ASIA archive.

Table 2: Indigenes, Aliens and Foreigners, by LLMAs, 2007 (indices, Italy = 1)

Manufacturing and Non-manufacturing LLMAs	*Incoming Aliens IAi (It=1)*	*Outgoing Indigenes OIi (It=1)*	*Incoming Foreigners IFi (It=1)*	*Typologies*
Manufacturing				
- Industrial districts	1.2	0.9	1.2	Open and xenophilous
- Industrial poles (a)	0.9	0.8	1.0	Middling
Italy (It)	*1.0*	*1.0*	*1.0*	*Middling*
Non-manufacturing				
- Metropolitan areas	1.2	0.9	1.0	Open
- Other LLMAs	1.2	0.9	1.2	Backward and repulsive

Notes: (a) LLMAs dominated by large firms. **Sources**: Data processing on ISTAT-ASIA archive.

[1] where $IA_i=1-[e_{ij}/(E_{i.}\cup f_i)]$, for $\forall$ i=j; $IF_i=f_i/(E_{i.}\cup f_i)$; $OI_j=1-(e_{ij}/E.j)$, for $\forall$ i=j; $IA=1-[E_{(i=j)}/(E..\cup F.)]$; $IF=F./(E..\cup F.)$; $OI=1-(E_{(i=j)}/E..)$; $E..=\sum_{ij}e_{ij}$; $F.=\sum_i f_i$; $E..\cup F.=\sum_{ij}e_{ij}+\sum_i f_i$; $E_i.\cup f_i=\sum_j e_{ij}+f_i$; $E._j=\sum_i e_{ij}$; $E_{(i=j)}=\sum_{ij(i=j)} e_{ij}$; and where F_i are entrepreneurs foreigners by birth that work in i-th region, e_{ij} are alien entrepreneurs by birth born in the j-th region and with economic activity in i.

Detected typologies of Regions and LLMAs are: *Backward and repulsive*, composed of Other (non-manifacturing) LLMAs and Southern Italian Regions (Campania, Sicilia, Calabria, Basilicata, Puglia and Molise) where it is possible to observe both the alien-entrepreneurial (Italian and foreign) lack of attraction and the exodus of the indigenes; *Close*, the Sardegna that, while arrives to keep the indigenes-entrepreneurs, fails to attract aliens-entrepreneurs; *Close but xenophilous*, composed of Veneto, Abruzzo, Trentino-Alto Adige, Umbria where it's possible to observe both the lack of national-entrepreneurial attraction and a foreigner-entrepreneurship attraction; *Open*, composed of Non-manufacturing Metropolitan LLMAs and of Lazio, Piemonte and Valle D'Aosta; *Open and xenophilous*, composed, on the contrary, of IDs and, among Regions, particularly, those that form the historic core of the *Terza Italia* (Toscana, Emilia and Marche) and the *ex-Triangolo Industriale* (Lombardia).

Conclusions

While considering the limitations of *secondary* use of administrative data, and the absence, in this experiment, of the specific quality control on demographic characteristics, from the analysis performed some first original results emerge (Fig. 1). The working-class culture intrinsic to district entrepreneurs [5] and the amount of aliens in the *industrial districts* (i.e. index = 1.2, Tab. 2), if taken together, are an example among others of the prospects of research on the evolution of IDs. Finally, it should be noted, that the empirical exercise proposed has been possible thanks to the existence of the ASIA archive [1, 7] and from the emergence of a new ISTAT approach – i.e. interconnected system of archives [6]. In fact, if a given population of entrepreneurs is a necessary precondition, a new approach which considers workers as a statistical unit in addition to firms is essential for quantitative analysis of business and demographic characteristics.

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Some aspects of socio demographic development in Tuscany from 1951 to 2001 according censuses data*

Edvige Maiozzi, Roberta Panaccione, Linda Porciani, Alessandro Valentini

Abstract
The aim of this paper is to give a contribution to the celebration of 150 years of unification of Italy analyzing the main aspects of socio-demographic changes in Tuscany during the last six decades. The study has been carried out on the basis of Census data, identifying a set of comparable indicators over time.
The results provide a framework of some of the most important social changes occurred in Tuscany population since the end of World War II, such as aging process, changes in female employment.

1 Data and methods

The population census is an effective tool for the observation of society and an unique way to analysis changes in the medium-term period. In this study, we concentrated our attention on Tuscany census data beginning from the post war period, since 1951 to 2001. To do that, firstly, 1951 and 1961 census Tuscany data were manually collected and imputed in an electronic data base. This represents in itself an added-value, because it gives the opportunity to have data easy to spread to the scientific community.

On the other hand the data has been meta-analyzed trying to identify a path of comparables variables collected in different censuses. The available information are different, reflecting the social changes of the country from decade to decade. The results of the work provide a grid of comparability useful to read the census data: it may

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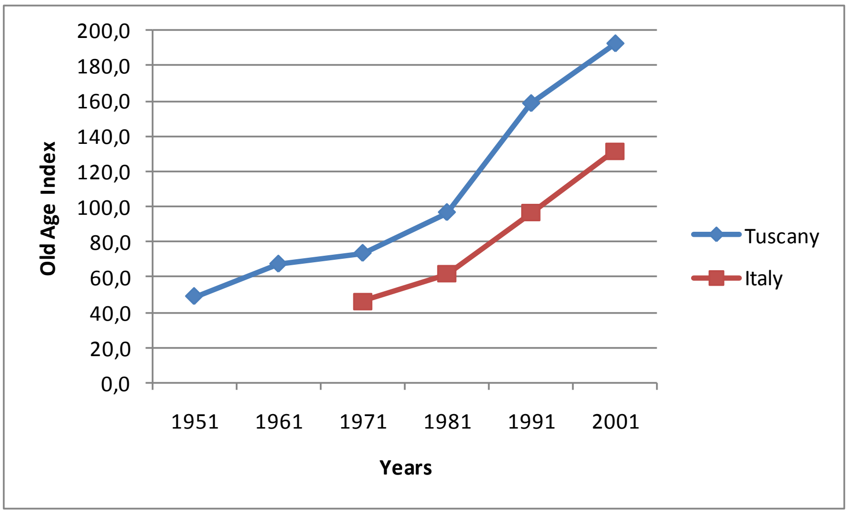
be extended to other local contexts and it has been the basic instrument for the preparation of a set of socio-demographic indicators identifying the main drivers of change in the Tuscan society.

In the following analysis, we show the main aspects of ageing index, family size, activity rate by sector and housing conditions.

2 An ageing society and a smaller family size: the two big demographic changes in Tuscany

Using census data from 1951 to 2001 it is possible to analyse trends of the ageing phenomena – and not the causes of the phenomenon - because censuses reveal the age structure of population. It is well known that Italian population is one of the most aged society of the developed world [3]. And it is note that this is due to two demographic factors: the low level of fertility (ageing from the bottom) and the growing of the expectancy life (ageing from the top). In this study, we represent the most used indicators to show the ageing process of the society, old age index, calculated as population over 65 years on the population between 0 and 14 years, the unique ageing measures comparable through censuses. Comparing to Italy, Tuscany had a faster ageing process (see Fig. 1), overall at the last two census. The most important difference between Italian and Tuscany ageing process is that while Tuscany overcomes the level of "100%" during the '70s, Italy does that during the '80s. Tuscan societies become aged earlier than Italian one, and still, at the last census, clearly shows the effect of a more rapid ageing process, with an old age index reaching almost 200%.

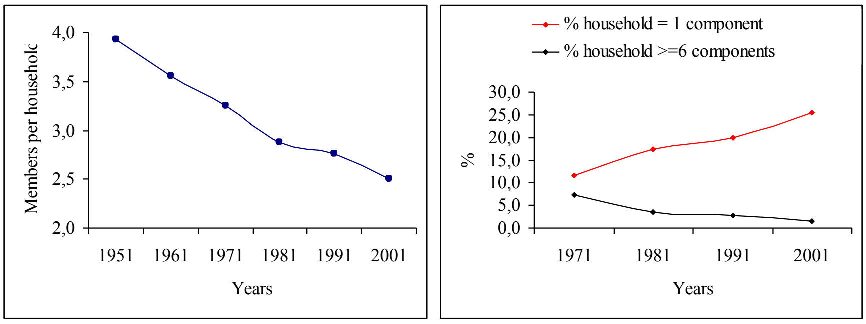
Figure 1: Old age index. Italy (Census 1971-2001) and Tuscany (Census 1951-2001).



Source: our elaboration on Censuses data

The other important demographic change in Tuscany, and in Italy as well, has been regarded family size. In the last 50 years the number of inhabitants in Tuscany grew of about 300 thousand inhabitants and reached 3.4 millions in 2001 (+9%). In the same period the number of households increased of ¾ reaching 1.4 millions (in 1951 families were a little more than 1 million) as a consequence of a segmentation process [2]. The number of members per household jumped down from 3.9 to 2.5. An important role in this process is played by households of only a component (11.7% in 1971; 25.4% in 2001). See Figure 2.

Figure 2: Members per household and percentage of households of a component. Censuses 1951-2001



Source: our elaboration on Censuses data

3 The employment framework

As illustrated in Table 1, in the 50's the leading sector was agriculture (with 39.6% of employees). The post-war development allows industry to become the most important sector of activity till 70's. In the last 30 years, services (called "other activities") turn out to be the predominant sector of employment. Almost in the same time, number of female in professional status increased significantly and doubled in the 50 years from 22.5% in 1951 to 41% in 2001.

Table 1: Active in professional status by sector of activity and gender (%) – Years 1951 - 2001

	Sector of activity					
Census	**Agriculture**	***of which female***	**Industry**	***of which female***	**Other activities**	***of which female***
1951	39,6	*21,7*	34,0	*19,2*	26,4	*27,9*
1961	24,2	*16,4*	44,1	*20,6*	31,7	*29,0*
1971	11,5	*16,2*	48,4	*22,5*	40,1	*34,0*
1981	6,7	*24,3*	43,7	*29,3*	49,6	*40,4*
1991	4,6	*29,0*	37,8	*29,0*	57,6	*44,0*
2001 (a)	4,1	*35,2*	34,8	*26,9*	61,1	*49,4*

Source: our elaboration on censuses data 1951 – 2001; (a) Percentages refer to employed

4 Housing condition

Tuscany housing conditions have experienced a considerable improvement during the last five decades especially for housing spaces availability and housing equipments. Census data analysis shows that housing number has remarkably increased passing by 740 thousand in 1951 to 1,667 thousand housing in 2001. Housing number grew quickly especially until the ‘80s with percent changes higher than 22% (table 2).

Table 2: Housing number in Tuscany

	1951	1961	1971	1981	1991	2001
Housing	740.398	921.467	1.131.811	1.390.067	1.546.676	1.667.100
Change %	---	24,5	22,8	22,8	11,3	7,8

Housing number increase is a relevant social change mostly because of greater availability of housing spaces impact on the households quality life [1]. During the last fifty years the number of occupants per room has quite halved passing by 1.01 in 1951 to 0.56 occupants per room in 2001. The improvement was particularly relevant during seventies and eighties when the number of occupants per room passed by values higher than 0.8 to values near to 0.6.

Another important indicator of the improvement in the quality of life is the availability of drinkable water. In 1951, 1 housing by 3 was served by drinkable water. Ten years later the percentage with drinkable water had quite doubled (62.2%) and in 1971 it gets over 85%. Since the eighties drinkable water became a minimum standard equipment that is present in over 9 housing by 10.

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Assessing the Effectiveness of Administrative Registers in Reducing Under-Coverage Errors in a Population Census: Evidence from the 2009 Italian Census Pilot Survey

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Abstract The paper assesses the performance of administrative archives in reducing under-coverage errors in register-assisted population censuses caused by poorly maintained population registers. Preliminary results from a simulation based on the 2009 pilot survey provide encouraging evidence on the usefulness of these auxiliary archives.

Key words: population census, record linkage, administrative registers.

1 Introduction

The 15th Italian Population Census to be held in October 2011 will be officially assisted for the first time in history by municipal population registers (*Liste Anagrafiche Comunali delle Famiglie e delle Convivenze* or LACs). Million of census questionnaires will be delivered by post at the address of each head of household as resulting from the respective LACs. Although by law LACs should be constantly updated to provide at any time a precise snapshot of the resident population living within the municipal borders, coverage errors – either permanent residents not listed (undercounts) or people who have left the municipality or passed away but have not yet been written off (overcounts)- are not uncommon. Therefore, within the new census strategy, the use of auxiliary administrative registers (*Liste Integrative da Fonti Ausiliarie* or LIFAs) to identify and count households and individuals not properly accounted for in the LACs is regarded as an important asset. Amidst these expectations, the real potential of the LIFAs – will include, *inter alia*, the National Tax Register and the Permits to Stay Archive– in reducing the undercount of the Italian population induced by poorly maintained municipal population registers is still largely unknown. At a stage where the criteria for the formation of the LIFAs are about to be defined, an assessment of the effective gains from using these registers is particularly timely and relevant.

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2 Data and methodology

The analysis is based on the Census Pilot Survey (CPS) carried out by ISTAT during the last quarter of 2009 in 31 municipalities [5]. Out of the 14 towns and cities where enumerators were instructed to visit all the dwellings located in the pilot Enumeration Areas (EAs) to track down those households missed out by the mail-out of census questionnaires, only four municipalities (Genova, Prato, Scandicci and Abbiategrasso) were considered in the paper. The choice was dictated by data quality issues which resulted in significant differences in the accuracy and completeness of the survey information across the 31 municipalities. These include two cities (Genova and Prato) with a population exceeding 150,000 and two middle-sized towns (Scandicci and Abbiategrasso) with a population between 20,000 and 50,000. The LACs refer to dates ranging from December 31st 2008 to May 31st 2009 depending on the municipality, i.e. they are between 5 to 10 months old at the time the CPS was conducted.

The main register for the construction of the LIFA is the National Tax Registry (*Anagrafe Tributaria* –AT) which contains about 80 million records nationwide. After excluding the deceased as well as the expatriates who are no longer in the country at the time of the survey a series of validation rules is applied to decide whether or not an individual record in AT should to be included in the LIFAs. For instance an individual record qualifies for inclusion if it is found for the same individual in other administrative registers such as student archives, maternity ward registries, pensioners' archives and others. In case some of the information for the same individual differs across two or more archives, the most recent available entry is retained in the LIFAs[2]. The size of the populations of interest whose records have been linked is shown in Table 1.

Table 1: Population size of the linked archives by municipality

Municipality	LAC updated to:	LAC	LIFA	CPS	Undercounts (UC)
Genova	31/12/2008	605895	57627	9716	316
Prato	31/05/2009	186608	43109	9536	273
Scandicci	31/01/2009	49764	2325	3573	9
Abbiategrasso	31/12/2009	31145	2734	2077	74

The paper uses probabilistic record linkage techniques to link up records from the CPS with the same record(s), if any, found in the corresponding LIFA. The model maximizes a log-likelihood function via an iterative EM algorithm proposed by Fellegi and Sunter [3]. The estimation is done using the software Relais 2.2 [4]. The analysis aims to determine how many of the residents missed out by the CPS's questionnaire mail-out *could have been found* on the basis of the supplementary information provided by the LIFAs[3]. The simulation is carried out at the municipal level. For each municipality the undercounts are defined as the members of those households living permanently at an address within the

[2] We are grateful to ISTAT's Central Department for Archives, and in particular to Carla Runci, for sharing the database and for the assistance in compiling the LIFAs. For more details on the LIFA's validation rules see [2].

[3] It should be noted that for the 2011 Census the LIFAs will be used before post-enumeration field operations begin to direct enumerators in their filed search.

municipal borders[4] which never received the questionnaire because the LAC contained no indication of their presence at that location. These individuals were included in the census only at a later stage when they were found by the enumerator in her door-to-door visits following the main questionnaire collection stage. These individuals are easily identified because their household questionnaires were assigned a different code type in the Enumeration Management System (SGR)[5]. Once identified, the records were linked with their municipal LIFA. The RL strategies are discussed in the next section.

3 Results

Table 2 presents the model's specification as well as the main results of the record linkage between the CPS and the LIFAs. RL strategies vary accordingly with the dimensions of the municipality and reflect the need to use more aggressive space reduction solutions in more populated localities in order to make estimation computationally feasible. For each municipality two indicators are used to assess the LIFAs: a) the percentage of UC that match with a LIFA record and b) the percentage of UC-LIFA links having the same address in both sources. The values of the first indicator vary significantly across the four municipalities (between 16.2% and 42.2%) suggesting that the current version of the LIFAs may be more effective in some places than others.

Table 2: RL model's specification and results

Municipality	Space reduction strategy	Blocking/ sorting variables	Matching variables	Comparison function [threshold]	UC in LIFA (links)	Links with CPS address coinciding with LIFA address
Genova	SNM	N, S	N,S,(A) D,M,Y	3-g [0.5] Equality	134 (42.2)	120 (89.6)
Prato	SNM	N, S	N,S,(A) D,M,Y	3-g [0.5] Equality	64 (23.4)	27 (43.5)
Scandicci	Blocking	G	N,S,(A) D.M.Y	Lev [0.7] Equality	3 (33.3)	3 (100.0)
Abbiategrasso	Cross product	-	N,S,(A) D,M,Y	Lev [0.7] Equality	12 (16.2)	11 (91.7)

Percentages in bracket.
SNM=sorted neighbourhood method, N=name, S=surname, D=day of birth, M=month of birth, Y=year of birth, A=address, G=gender, NS=namesurname, Lev=Levenshtein, 3-g=3-grams.

If one excludes Prato, the second indicator shows that a fairly high rate of records would have been found by the enumerators if they were visited at their LIFA address[6]. This finding

[4] In the CPS, the borders coincide with those of the census EAs selected for the pilot survey.

[5] We are grateful to Lorenzo Cassata for his help and troubleshooting on the SGR.

[6] It is likely that the degree of success of the LIFAs in locating and counting the undercounts would have been higher had the enumerator known in advance the whereabouts and composition (number of members, age, gender, nationality) of households rather than just calling by at every dwelling located in the EA.

is encouraging because by and large the addresses recorded in the LIFAs appear to provide a reliable signal in order to locate households missed out in the census mail-out. The lower value for Prato suggests that the success of the LIFAs is likely to depend upon the size of the foreign population living within the municipal borders. Prato is home to a notoriously large Chinese population and it is no coincidence that the LIFAs perform relatively poorly compared to other places. Summary statistics (not shown) reveal that in Prato about 39% of the undercounts have non-Italian citizenship compared to 26% in Genova, 28% in Abbiategrasso and 11% in Scandicci[7].

4 Concluding remarks

The 2011 Italian General Census of Population and Dwellings will be assisted for the first time by municipal-level population registers (LAC). In order to minimize coverage errors induced by poorly maintained LACs, the National Institute of Statistics has decided to use auxiliary population archives from alternative sources, called LIFA. Despite expectations of their usefulness are high, little is known on the real benefits from using the LIFAs. In order to assess the degree of success of these auxiliary archives in locating and including in the census residents unaccounted for by the municipal population registers, probabilistic record linkage models were estimated to match individual records found in the 2009 Census Pilot Survey (CPS) but not in the LACs with records contained in the LIFAs. The latter were constructed around the National Tax Register as the pivot database and then enriched and validated by entries from a series of other public registries. The results of the simulation exercise are encouraging and show that the LIFAs could provide reliable guidance to enumerators trying to locate individuals not yet counted in the census. However, the performance of the LIFAs differs significantly across municipalities. One critical aspect affecting their success appears to be the size of foreign population living within the municipal borders. This suggests that the effectiveness of the LIFAs is likely to increase when the Permits to Stay Archive will be integrated in. In any case, it is clear that the LIFA cannot be used in isolation and need to be combined with other instruments in order to thoroughly tackle under-coverage errors.

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[7] Similar results were found by Fortini and Gallo for the 2001 Census. For more details see [1].

A family of indexes for University teaching evaluation

Donata Marasini and Piero Quatto

Abstract In order to analyze the student ratings of university teaching, several indexes summarize the percentages of positive and negative responses in a single numerical value. Focusing on linear functions of response percentage, the paper studies some interesting families of indexes for the measurement of student satisfaction. Special attention is paid to relationships between these families and a particular family that arises in a natural way.

1 Introduction

Italian Universities are required to carry out a survey on student satisfaction and teaching facilities.

CNVSU (National Evaluation Committee of the University System) annually requests Evaluation Commissions to provide a summary by means of the percentages of positive and negative ratings.

In particular CNVSU [5] has provided a questionnaire outline that Universities have to comply in the content but not necessarily in the form, meaning that any CNVSU items should be present in the questionnaire, but the answer can be articulated in different ways.

For example, such a questionnaire may be consistent with the requirements of CNVSU involving four response categories: decidedly no *(DN)*, more no than yes *(MN)*, more yes than no *(MY)*, decidedly yes *(DY)*; otherwise, the questionnaire can be structured on a far richer and more sensitive scale.

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Once chosen an ordinal scale, Universities summarize the student ratings through suitable indexes of student satisfaction [1, 2, 3, 4, 6].

The present paper aims to identify a summary formula of some indexes adopted by Italian Universities.

In this regard, we consider indexes which refer to items based on the four above mentioned categories, such as the following question: “Overall, are you satisfied with this course?”.

In Section 2 we show how these indicators can be grouped into one family IS_w and we introduce the subfamily IS_k of IS_w whose elements are useful in practice.

In Section 3 we set the focus on the subfamily IS_{w^*} of IS_w that has certain characteristics and we verify the equality of the corresponding normalized families.

Then we show that there is a linear relationship between elements belonging to IS_{w^*} and elements belonging to IS_k.

2 The families IS_w and IS_k

With reference to a specific item of the questionnaire, let p_1, p_2, p_3 and p_4 be relative frequencies corresponding, respectively, to ordinal responses *DN*, *MN*, *MY* and *DY*.

Student satisfaction indexes employed by many Universities all belong to the following family

$$IS_w = \sum_{j=1}^{4} w_j p_j \tag{1}$$

where the components w_j of the vector $w = (w_1, w_2, w_3, w_4)$ are the weights assigned to the relative frequencies.

In this context, the weights are considered as predefined constants such that $w_1 \le w_2 \le w_3 \le w_4$.

For instance, if $w = (1,2,3,4)$, $w = (2,5,7,10)$ or $w = (0,0,1,1)$, then (1) represents the weighted mean hereinafter denoted by $IS_{(1,2,3,4)}$, $IS_{(2,5,7,10)}$ or $IS_{(0,0,1,1)}$, respectively, [3].

In general, if $w = (-1, -k, k, 1)$ with $0 \le k \le 1$, then (1) provides the subfamily of IS_w denoted by IS_k.

Besides the two families of absolute indexes, we consider the corresponding families of normalized indexes.

In particular, with regard to (1), we have

$$\widetilde{IS}_w = \frac{\left(\sum_{j=1}^{4} w_j p_j\right) - w_1}{w_4 - w_1} = \sum_{j=1}^{4} \frac{(w_j - w_1) p_j}{w_4 - w_1} = \sum_{j=1}^{4} z_j p_j \tag{2}$$

where

$$z_1 = 0 \qquad z_2 = \frac{w_2 - w_1}{w_4 - w_1} \qquad z_3 = \frac{w_3 - w_1}{w_4 - w_1} \qquad z_4 = 1 \tag{3}$$

and with regard to IS_k we obtain

$$\widetilde{IS}_k = \frac{IS_k + 1}{2} = \sum_{j=1}^{4} \frac{(w_j + 1) p_j}{2} = \sum_{j=1}^{4} z_j p_j \tag{4}$$

where

$$z_1 = 0 \qquad z_2 = \frac{1-k}{2} \qquad z_3 = \frac{1+k}{2} \qquad z_4 = 1 \tag{5}$$

3 The subfamily IS_{w*}

Among all indexes included in IS_w **,** those satisfying the equality

$$w_4 - w_3 = w_2 - w_1 \tag{6}$$

seem to be of particular interest, due to the fact that (6) represents a condition of symmetry between *DN* and *DY* whatever the two central categories.

The set of indexes satisfying (6) forms the subfamily IS_{w*} of IS_w which we refer in this Section.

Obviously, the elements of IS_k satisfy (6) and therefore $IS_k \subset IS_{w*}$.

With respect to the normalized version $\widetilde{IS}_{w*}$ of IS_{w*}, if we define

$$k = \frac{w_3 - w_2}{w_4 - w_1} \tag{7}$$

the coefficients z_2 and z_3 appearing in (5) are equal to their counterparts given in (3). Conversely, equating the coefficients z_2 and z_3 with those of (5), we obtain (6) and (7). Hence, it follows that $\widetilde{IS}_{w*} = \widetilde{IS}_k$.

Recalling (4), we have $IS_k = 2\widetilde{IS}_k - 1$ and this equality can be rewritten as

$$IS_k = 2\widetilde{IS}_{w*} - 1 = 2\frac{IS_{w*} - w_1}{w_4 - w_1} - 1 = \frac{2}{w_4 - w_1} IS_{w*} - \frac{w_1 + w_4}{w_4 - w_1} \tag{8}$$

Thus, (8) expresses the linear relationship between an element of IS_{w*} and an element of IS_k.

So, with respect to the three indexes $IS_{(1,2,3,4)}$ (adopted by University of Torino), $IS_{(2,5,7,10)}$ (adopted by University of Firenze), $IS_{(0,0,1,1)}$ (adopted by CNVSU) introduced in the previous Section, the linear relationships are as follows

$$IS_{1/3} = \frac{2}{3} IS_{(1,2,3,4)} - \frac{5}{3}$$

$$IS_{1/4} = \frac{1}{4} IS_{(2,5,7,10)} - \frac{6}{4}$$

$$IS_1 = 2IS_{(0,0,1,1)} - 1$$

where $IS_{1/3}$ is adopted by University of Insubria and $IS_{1/2}$ by University of Pavia.

From the two conditions $IS_k \subset IS_{w*}$ and $\tilde{IS}_k = \tilde{IS}_{w*}$ it follows that the relationship between IS_k and IS_{w*} is not bijective, in the sense that there may be more indicators belonging to the family IS_{w*} that give rise to the same index of the family IS_k .

For example, index $IS_{(3,9,15,21)}$ is related to $IS_{1/3}$ by means of the relationship

$$IS_{1/3} = \frac{1}{9} IS_{(3,9,15,21)} - \frac{12}{9}.$$

The same is true for indexes $IS_{(3m,9m,15m,21m)}$, where *m* is any real number. Similarly, index $IS_{(5,20,30,45)}$ is related to $IS_{1/4}$ by means of the relationship

$$IS_{1/4} = \frac{1}{20} IS_{(5,20,30,45)} - \frac{25}{20}.$$

The same is true for indexes $IS_{(5n,20n,30n,45n)}$, where *n* is a real number. Moreover, index $IS_{(1,1,10,10)}$ is related to IS_1 by means of the relationship

$$IS_1 = \frac{2}{9} IS_{(1,1,10,10)} - \frac{11}{9}.$$

The same is true for indexes $IS_{(r,r,t,t)}$, where *r* and *t* are real numbers. All such relationships allow us to compare the indexes used by different universities.

In choosing a suitable measure of student satisfaction, the relationship between elements of IS_{w*} and elements of IS_k suggests that we can restrict our attention to IS_k, since the indexes belonging to this family have the advantage of reducing the weight of categories *MN* and *MY* as compared to *DN* and *DY*, because of the fact that $0 \le k \le 1$ and that the two categories *MN* and *MY* are generally more frequent than *DN* and *DY*.

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Uno sguardo alla Statistica dal 1861 al 1981

Donata Marasini

Abstract This paper aims to outline the development of Statistics from 1861 to 1981 with respect to its contents. The paper pays particular attention to some statistical topics which have been covered by basic introductory courses in the Italian Universities since the beginning of the Italian unification process. The study is limited to the 120-year period mentioned above as from the 80s Statistics has passed through a period of drastic change that deserves a separate discussion in itself. The review takes as its starting point the well-known book "Filosofia della Statistica" of Melchiorre Gioja. This volume was published 35 years before Italian unification but it already contains the fundamental topics of exploratory and inductive Statistics. These topics give the opportunity to mention a few Italian statisticians who are considered the founders, although many others Italian scholars over time have contributed substantially to the development of this discipline. In particular, the attention is focused on four statisticians: Corrado Gini, well-known for its modern insights; Marcello Boldrini, a man of great culture, also in the epistemological field; Bruno de Finetti, founder of subjective school and Bayesian reasoning; Giuseppe Pompilj, precursor of random variables and sampling theories. After considering several reference books until the mid'90s, the paper browses the indexes of three well-known Italian handbooks that, although published in the 80s, deal with topics covered in some basic teachings of exploratory Statistics, Statistical inference and Sampling theory from finite population.

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1 Introduzione

Gli autori italiani che hanno dedicato idee e contributi alla Statistica dall'unità di Italia sono veramente molti. La scelta adottata in queste pagine è stata quella di fissare l'attenzione su contributi che hanno costruito le basi della Statistica italiana e di citarne altri che l'hanno arricchita, con particolare riguardo ai contributi che risalgono alla fine degli anni '60, perché si ritiene che quanto figura nella letteratura dall'unità d'Italia fino a quegli anni abbia costituito un nucleo davvero solido da cui partire per gli argomenti da trattare negli insegnamenti di base di Statistica presenti nella quasi totalità degli Atenei italiani. Inoltre si è scelto di prendere in considerazione argomenti che rientrano nella Statistica "tout court" in particolare nella Statistica descrittiva, in quella inferenziale e nella Teoria dei campioni, con solo qualche cenno alle Statistiche applicate.
Nel decennio 1970-1980 si aggiungono contributi importanti nell'inferenza statistica, sia secondo la tradizionale scuola oggettivista, sia secondo la moderna scuola soggettivista; tuttavia il tecnicismo che li accompagna li rende sovente di difficile inserimento negli insegnamenti di base. Entra la Teoria dei campioni da popolazione finita che, stante il suo veloce sviluppo, trova la sua completa sistemazione a partire dal decennio successivo. Infine iniziano i contributi sull'analisi dei dati che, consolidatisi anch'essi a partire dal decennio successivo, danno origine ad una nuova epoca. Campionamento e analisi dei dati, e più in generale analisi multidimensionale, entrano più tardi nei manuali di studio. Di questo decennio si farà pertanto solo un breve cenno, arrivando comunque alla fine degli anni '70, ovvero considerando solo 120 e non 150 anni, con solo tre eccezioni. Questa scelta è motivata dal fatto che proprio agli inizi degli anni '80 la Statistica subisce una grande rivoluzione in conseguenza del fatto che la ricerca è sempre più orientata al "multidimensionale" ed è supportata da uno straordinario e sempre più sofisticato impianto tecnologico. Ma in un certo senso, al di là delle "più dimensioni" o del supporto di eccezionali software statistici in grado di risolvere quanto a suo tempo il ricercatore faceva con la matita o con il gesso, cambia anche il modo di pensare in sintonia con l'evoluzione della società e le sue nuove esigenze.
Un esempio per tutti. Fino a quella data -fine anni '70- il controllo di qualità si riferisce al mondo della produzione industriale con le famose carte di controllo tramite le quali accettare o rifiutare un "pezzo prodotto". Con gli anni '80 il controllo della qualità si estende diventando anche e, soprattutto, "valutazione della qualità": della didattica universitaria, dei servizi, della customer satisfaction e così via.
Questo cambio di visuale merita di essere trattato in via del tutto autonoma ed esula pertanto dal contenuto di queste pagine.

L'excursus prende le mosse dal ben noto volume di Melchiorre Gioja "Filosofia della Statistica" del 1826, precedente di 35 anni l'unità, poiché contiene le basi della Statistica descrittiva e parzialmente di quella induttiva. I diversi concetti, tra l'altro, danno l'opportunità di citare, anche se a volo di uccello, alcuni statistici italiani che hanno dato il loro contributo fino alla fine degli anni '60.
In ogni caso un trattamento a sé meritano alcuni studiosi che, con le loro peculiarità, sono stati portatori di novità. Per fare il punto su che cosa figura oggi nei manuali di Statistica descrittiva, di Statistica inferenziale e di Teoria dei campioni si sfogliano gli indici di tre attuali manuali di Statistica, anche se fuori dal periodo preso in esame.

2 La Statistica e Melchiorre Gioja

Nella lettura del volume di Melchiorre Gioja (M.G.) del 1826 (29) si è scoperto come le parole che accompagnano gli indici che l'autore propone, la loro interpretazione e le intuizioni sono così acute che sembrano avere gettato le basi sia per le tecniche statistiche tradizionali, sia anche per quelle più avanzate.
L'autore ha anticipato, certamente in modo naive, contenuti che oggi sono presenti in insegnamenti di Statistica descrittiva, di Statistica economica e di Demografia ritenuti indispensabili per tutti i Corsi di studio di natura statistica.
Inizia introducendo le serie storiche, uno dei punti cardine della Statistica economica, della Econometria e della Statistica metodologica che hanno come precursore Silvio Vianelli (1) che nel 1948 fornisce una sistemazione metodologica. E' di Luigi Vajani (1) una trattazione organica negli anni '60, mentre la trattazione moderna avviene con i modelli ARIMA negli anni '70.
Per sintetizzare i dati M.G. dà grande rilievo alla media aritmetica che oggi, tra le numerose medie analitiche esistenti, è la più impiegata e la più conosciuta certamente per la sua semplicità e la sua intuitiva interpretazione. La media aritmetica rimane un punto chiave nell'insegnamento della Statistica descrittiva, accompagnata spesso da approcci più sofisticati che la generalizzano.
I principali contributi degli statistici italiani sui valori medi vanno dai primi del '900 fino verso gli anni '70.
Si ricordano i contributi di Angelo Messedaglia del 1881 (18); i numerosi lavori di Carlo Emilio Bonferroni ad iniziare dal 1924 (1); l'interessante approccio di Oscar Chisini del 1929 (10), citato in pressoché tutti gli attuali volumi di Statistica descrittiva. Va ricordato l'acuto lavoro di Bruno de Finetti sulle medie associative del 1931 (15) e, ovviamente, quello di Corrado Gini del

1938 intitolato “Di una formula comprensiva delle medie” (24) che sarà uno degli innumerevoli lavori sull’argomento che poi porterà al volume “Le medie” del 1958 (26). Deve ancora ricordarsi l’apporto di Marcello Boldrini che introduce nel 1940 il concetto di media “tipica” (1). L’approccio di Chisini viene poi criticato da Amato Herzel che in un lavoro del 1961 (30) sostituisce alla semplice intuizione del primo, una complessa articolazione del tutto generale.
Nell’impostazione di M.G. la variabilità è un concetto intuitivo che riguarda fenomeni quantitativi e qualitativi.
I contributi degli italiani su questo tema iniziano con C. Gini nel 1912 con il lavoro “Variabilità e mutabilità. Contributo allo studio delle distribuzioni e relazioni statistiche” (20). Molto interessante e del tutto attuale è il suo indice per la misura della mutabilità che si trova nella maggior parte dei manuali di Statistica descrittiva e fondamentali sono suoi contributi sulla concentrazione. Seguono altri lavori altrettanto importanti di Gaetano Pietra che fornisce i suoi contributi a partire dagli anni ’30 (1), di de Finetti (1) e di Bonferroni (1).
Sul tema della concentrazione intervengono Vittorio Castellano nel 1937 (1) e Vittorio Amato (1) alla fine degli anni ’40; Mario De Vegottini alla fine degli anni ’40 (1) e Tommaso Salvemini nel 1948 (1) forniscono interessanti contributi sulla variabilità relativa. Paolo Fortunati inizia nel 1952 (1) ad occuparsi della variabilità ed Herzel inizia con il suo lavoro del 1967 (1).
L’interesse per la variabilità continua nel tempo con maggiore intensità rispetto a quanto accade alle medie: ad esempio Giampaolo Zanardi e Vittorio Frosini contribuiscono ai capitoli della variabilità e della concentrazione a partire dagli anni ’60 (1).
M.G. si occupa di percentuali e rapporti che, secondo i casi, oggi sono definiti rapporti di composizione, numeri indice o rapporti di densità che entrano nei programmi di base di Statistica e di Statistica economica. Guido Mortara nel 1913 (36), Gini negli anni ’30 (1), Albino Uggè nel 1942 (42) e Carlo Benedetti (1) a partire dagli anni ’60 sono i principali artefici di questa materia in Italia.
I rapporti sono strumenti indispensabili anche in Demografia dove i contributi sono di Gini (19), ma anche di Livio Livi (31), Mortara dal 1912 (35) sino all’inizio degli anni ’40, Boldrini nel 1956 (6) e più recentemente Bernardo Colombo (14) e Massimo Livi Bacci (32) affrontano temi squisitamente demografici.
Passando ora alla parte induttiva, M.G. introduce il concetto intuitivo di probabilità. Alla probabilità hanno dedicato i propri studi, oltre a Gini, a de Finetti e a Pompilj, come si accenna nel prossimo paragrafo, Guido Castelnuovo con il primo manuale sul “Calcolo delle probabilità” del 1919 (9) e Francesco Paolo Cantelli (1) a iniziare dagli anni ’30.

M.G. introduce poi un altro concetto intuitivo: quello di stima. In Italia alla teoria della stima puntuale e intervallare hanno fornito i principali contributi, Luigi De Lucia, Herzel, e Alighiero Naddeo (1) negli anni ’60.
Per M.G. strettamente legato al concetto di stima è quello del campionamento. Un accenno al campionamento viene fatto da Gini e Luigi Galvani nel 1929 (23) ma la Teoria dei campioni nasce in modo ufficiale con il manuale di Pompilj del 1952 (39) e poco dopo con il manuale di Castellano del 1955 (8). Si solidifica nel decennio 1970-1980 con i contributi ad esempio di Herzel del 1973 (2) e di Zanella nel 1974 (2) ma, come si è già precisato, esplode solo a partire dagli anni ’80.
M.G. fa continuo riferimento ad una pluralità di variabili le une collegate alle altre in modo del tutto generico, ovvero considerandone alcune come cause di altre, facendo nascere i concetti di connessione, associazione, dissomiglianza, cograduazione e regressione, alcuni dei quali inseriti in insegnamenti di base. Autori italiani che si sono occupati di questi argomenti sono Salvatore Bertino, Bruno Baldessari, Herzel (1) con riguardo alla connessione, Giampiero Landenna con riguardo alla connessione (1) e alla dissomiglianza (33), Alfredo Rizzi ha trattato la cograduazione (1), Salvemini e Giovanni Girone la dissomiglianza (1).
Per quanto riguarda la regressione, Gini negli anni ’40, Bonferroni nel 1942, Pompilj nel 1946 e Amato nel 1949 hanno contribuito al suo sviluppo (1).
Che cosa succede degli altri argomenti che M.G. non ha toccato, ad esempio la verifica di ipotesi. In questo campo sono davvero molti gli studiosi italiani che hanno fornito il loro contributo soprattutto, come già precisato, nel decennio 1970-1980. Adottando il criterio di citare solo gli statistici antecedenti al 1970, oltre a Gini (27) e a Pompilj (38) che hanno mosso critiche ai test di significatività, figurano in stretto ordine alfabetico: Baldessari, Odoardo Cucconi, Mario Di Bacco, Luigi Faleschini, Landenna, Naddeo, Rizzi, Giovanni Battista Tranquilli, Michele Zenga (1).
Nell’analisi della varianza, argomento sovente inserito negli insegnamenti di base, si ricordano Faleschini e Ludovico Piccinato (1), oltre a molti altri autori, tra i quali Pompilj (40) e Zanella (1), che si sono occupati di piano degli esperimenti.
Tornando all’analisi multivariata e, in particolare, alla classica analisi dei dati, i precursori sono Mario Badaloni e Rizzi, Giuseppe Lunetta, Antonino Mineo, Naddeo, Sergio Zani (1). Ma l’analisi dei dati, così come altre tecniche e modelli multivariati trovano la loro piena articolazione dopo il 1980, periodo che come si è già precisato non viene preso in considerazione in queste pagine.
A tutti gli studiosi appena citati dovrebbero esserne aggiunti molti altri, altrettanto noti a livello nazionale e internazionale, che hanno contribuito allo sviluppo della Statistica nel decennio in questione. I loro contributi sono

raccolti nel volume “Italian Contributions to the Methodology of Statistics” (SIS, 1987).

3 L’entrata della Statistica nell’Accademia italiana

Verrà ora realizzato un breve excursus storico relativo all’entrata della Statistica nell’accademia italiana.
Le più antiche Università con un insegnamento di Statistica sono state Padova e Pavia, ma a queste ben presto si sono aggiunte Palermo, Roma, Napoli, Bologna, Ferrara, Milano, Torino, Firenze. La Statistica obbligatoria dal 1876 in tutte le Facoltà di Giurisprudenza, con la riforma Gentile del 1923, viene introdotta anche in altre Facoltà e ovviamente nella Facoltà di Scienze Statistiche nata a Roma nel 1936.
Per quanto riguarda i manuali di Statistica adottati negli Atenei dall’unità di Italia sino ai primi anni del ‘900, si può consultare il lavoro di Giovanni Favero del 2006 (18). In particolare, nel presente contesto si vuole ricordare Angelo Messedaglia che ha lasciato numerose monografie e appunti, oltre al volume “Corso di Statistica” del 1872 (18), soprattutto come docente nell’Università di Roma; Antonio Gabaglio, docente nell’Università di Pavia, che ha pubblicato il volume “Teoria generale della Statistica” nel 1888 (18). Nel 1885 viene attivato il primo insegnamento di Demografia a Firenze ed è di Rodolfo Benini il primo trattato di Demografia del 1901 (3) seguito poi nel 1906 da “Principi di Statistica metodologica” (18). L’attributo “metodologica” segnala come la disciplina Statistica stia cambiando: da disciplina legata allo stato e alla sua popolazione, come l’ha intesa M.G., vera e propria scienza. A Benini si affianca Napoleone Colajanni che nel 1904 ha scritto il “Manuale di Demografia” (12) e sempre nel 1904 il “Manuale di Statistica” (13).
I fondamenti della Statistica non possono prescindere da un rapido cenno al contributo di Corrado Gini che ha dominato l’ambiente statistico per i primi 60 anni del ‘900.
Fondatore nel 1920 della rivista Metron; fondatore nel 1926 e anche presidente dell’Istituto centrale di statistica; fondatore della rivista Genus nel 1934; presidente della Società italiana di statistica nata nel 1939.
Gini, dopo il suo primo contributo del 1912, scrive nel 1914 “Appunti di statistica” (22) relativi alle lezioni tenute nell’Università di Padova prima di trasferirsi a Roma nel 1925. Benché il suo interesse sia stato principalmente rivolto alla Statistica descrittiva, si è molto occupato anche di probabilità. Uno dei primi lavori al riguardo è “Che cos’è la probabilità” del 1908 (28) seguito poi dalla memoria del tutto innovativa “Considerazioni sulle probabilità a

posteriori" del 1911 (28) e sempre sulle probabilità è davvero rivelatore il suo discorso "I pericoli della statistica" dove getta le basi per la revisione sistematica dei principi della metodologia statistica.
Questi e altri scritti sulla Statistica induttiva e sul Calcolo delle probabilità sono raccolti in due volumi del 1967 (27) e del 2001 (28) di eccezionale profondità. In particolare nella prefazione al primo scritta da Vittorio Castellano e Paolo Fortunati si legge " Gini ha fatto progredire la metodologia statistica in varie direzioni …..e in ciascuna di questa ha apportato più di qualche cosa di nuovo, ma nel calcolo delle probabilità il suo merito davvero grande è stato quello di rifiutarsi di progredire, quando progredire ha cominciato a significare illudersi di avere scoperto l'impossibile e, trovando le regole dell'induzione, avere trasformato questa in deduzione"; frase ripresa poi da Italo Scardovi nella sua prefazione al secondo volume. Il profilo tracciato è davvero di un grande ricercatore.
La metodologia proposta alla fine degli anni '30 da Sir Ronald A. Fisher ha incontrato una certa resistenza da parte di Gini anche perché l'incalzante tecnicismo matematico rischiava di trasformare la Statistica rendendola una scienza astratta. Nelle due comunicazioni alla Società Italiana di Statistica "A proposito dei testi di significatività" (28) e "I testi di significatività" (28), dove dominano la probabilità diretta e inversa, sono evidenti le sue perplessità.
La scelta di tre altri studiosi che insieme a Gini hanno contribuito ad arricchire la Statistica è caduta su Marcello Boldrini, Bruno de Finetti e Giuseppe Pompilj.
Marcello Boldrini, studioso, politico e personaggio di spicco nell'industria petrolifera, si è occupato di fondamenti della Statistica, della Demografia e della Biometria, scrivendo il volume "Biometria e antropometria" del 1934 (4), tutte discipline che ha insegnato a partire dal 1922 in diversi Atenei italiani, ultimo dei quali l'Ateneo romano. Nel 1942 ha scritto il volume "Statistica: teoria e metodi" (5) dove, tra l'altro, si trova l'argomento di Teoria dei campioni inteso come inizio dell'induzione con particolare riguardo alla scoperta di leggi nell'ambito delle scienze. Boldrini ha parlato di epistemologia, ha affrontato il problema dell'induzione sotto il profilo storico filosofico, ha discusso di probabilità e di Statistica aprendo la strada ai fondamenti della Probabilità e della Statistica (7).
Bruno de Finetti, è entrato nell'Università di Trieste nel 1939 in qualità di Matematico finanziario e nel 1954 si è spostato a Roma con l'insegnamento di Calcolo delle probabilità. Tra i suoi molteplici ambiti di studio e di ricerca spicca in particolare quello della probabilità. Il suo punto di vista sulla probabilità è stato presentato da de Finetti stesso a Parigi nel 1935 in una serie di cinque conferenze all'Istituto Poincaré note con il titolo "La prévision: ses lois logique, ses sources subjectives" (16) e ha trovato poi completa

sistemazione nei due volumi “Teoria delle probabilità” del 1970 (17), tradotti in lingua inglese per Wiley e in lingua tedesca per Oldenbourg Verlag.
Fondatore ideale della scuola soggettivista, sostenitore del ragionamento bayesiano riesce a contrapporre questa scuola alla scuola oggettivista fino ad allora unica e incontrastata.
Giuseppe Pompilj, abbandonata l’accademia in seguito alla guerra e a una lunga prigionia, è ritornato nel 1948 all’Università di Roma e ha ricoperto gli insegnamenti di Geometria e di Calcolo delle probabilità nella Facoltà di Scienze statistiche, occupandosi, tra i primi in Italia, di variabili casuali (41), con un taglio estremamente moderno e molto vicino a quanto avveniva all’estero alla fine degli anni ‘40. Come si è già precisato, si è rivolto alla Teoria dei campioni (39) che ha visto sia nell’accezione attuale di campionamento da popolazione finita, sia come strumento per realizzare l’inferenza.
A tutti gli studiosi finora considerati, vanno aggiunti due statistici italiani: Fortunato Pesarin e Italo Scardovi, a tutt’oggi preziose figure di riferimento per la Statistica, in particolare il primo è di riferimento per i test di permutazione e il secondo per i fondamenti epistemologici.

4 Sfogliando alcuni manuali

Ciò che viene impartito attualmente negli insegnamenti di base della Statistica è contenuto nei tre manuali: “Statistica descrittiva” di Leti del 1983 (34), “Statistica” di Piccolo nella versione del 1998 (37) e il “Campionamento statistico” di Cicchitelli-Herzel-Montanari nella versione del 1992 (11) che vanno al di là del periodo considerato e che costituiscono le tre eccezioni di cui si è detto nell’introduzione. Detti manual, fra i molti altri esistenti oggi in Italia, sono di riferimento per la loro completezza.
Il primo, dopo le fasi iniziali della raccolta dei dati e le rappresentazioni grafiche, fissa l’attenzione sulle distribuzioni univariate, con i valori di sintesi come le medie e le medie lasche, con la variabilità e i principali indici per la sua misura, con la concentrazione, con alcune misure per l’asimmetria. Con riguardo alle distribuzioni di due o più caratteri, introduce, insieme a molti altri concetti, la connessione, la regressione e la correlazione.
Il secondo manuale, tra l’altro, introduce il calcolo delle probabilità e le variabili casuali e con riguardo all’inferenza statistica, espone la teoria della stima puntuale, introducendo stimatori e le loro proprietà, la teoria della stima intervallare e la teoria dei test secondo diverse impostazioni. Introduce poi i modelli di regressione semplice e multipla.

Il terzo manuale, infine, tratta in modo organico la Teoria dei campioni da popolazione finita introducendo diversi piani di campionamento di fatto impiegati nella realtà con probabilità costanti e variabili. Fornisce le stime per il totale e per la media di un carattere e affronta il tema della dimensione campionaria e degli errori campionari e non.
I tre volumi, stante la loro ricchezza, trattano altri argomenti più particolari e più sofisticati, anche se non meno importanti, che possono essere affrontati in insegnamenti di Corsi di laurea magistrale con particolare riguardo alle Facoltà di Scienze statistiche.

5 Conclusione

Nei paragrafi precedenti si è tracciata la storia sull'origine degli argomenti che entrano a fare parte degli insegnamenti di Statistica ritenuti di base, escludendo per lo più quelli legati alle applicazioni della medesima, come la Statistica economica o la Demografia che comunque, come si è già detto, accompagnano quasi sempre i primi in Corsi di studio di natura statistica.
Si è posta l'attenzione sugli argomenti che si sono sviluppati fino alla fine degli anni '70. In particolare si è visto come la Statistica descrittiva ha avuto le sue origini già all'inizio del periodo e via via si è arricchita, mentre la Statistica inferenziale, con la teoria della stima puntuale e intervallare e con quella dei test, è stata introdotta in un secondo tempo, ma una volta consolidata ha attirato l'attenzione e l'interesse di molti ricercatori.
L'analisi si è fermata quando la tecnologia nel decennio successivo ha consentito di introdurre in Italia la Statistica multivariata o multidimensionale; per questo motivo sono stati rimandati ad altra sede argomenti più attuali della Statistica che entrano in insegnamenti di livello avanzato, nonché quelli che riguardano le simulazioni o il data mining, che fanno uso intensivo del computer e che figurano in insegnamenti di elite di alcune Facoltà di Scienze statistiche.
Dal breve excursus storico sembra emergere che in Italia la disciplina Statistica sia stata molto considerata nell'800 e nella prima metà del '900 e meno nella seconda metà. In Italia la Statistica ha tenuto la sua posizione di disciplina autonoma dalla Matematica finché non si è voluto seguire pedissequamente la scuola anglosassone la cui influenza ha portato alla denominazione di Statistica matematica. Anche agli inizi del 2000 la Statistica resta in un certo senso "dominata" dalla Matematica, impressione, d'altro canto, supportata dal numero esiguo di studenti interessati alla disciplina statistica o informati della sua esistenza.

Solo in quest'ultimo quinquennio sembra che la Matematica e la Statistica abbiano trovato un modo non solo per convivere ma anche per collaborare in un'ampia visione di multidisciplinarietà.
Ne sono una testimonianza le seguenti parole del matematico americano: Arthur Benjamin che in una conferenza esordisce così "If President Obama invited me to be the next Czar of Mathematics, then I would have a suggestion for him that I think would vastly improve the mathematics education in this country….. I think if our students, if our high school students - if all of the American citizens - knew about probability and statistics, we wouldn't be in the economic mess that we're in today. …… In summary, instead of our students learning about the techniques of calculus, I think it would be far more significant if all of them knew what two standard deviations from the mean means".

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The improvement on production matrix in the Italian national accounts revision 2011

Sandra Maresca and Carmela Squarcio

Abstract The enterprise market production matrix is estimated differently depending on branch or product. In general, the matrix is constructed by allocating the output of each branch to the cells of the corresponding column. The procedure by column is the most important since the production matrix identifies the share of secondary output on the overall branch production and assigns it to the specific products. The estimation is based on Istat annual surveys on enterprises: large enterprises business account survey (Sci), small and medium sized enterprise survey (Sme), industrial production survey (Prodcom) and on enterprises' statistic-based tax assessment (Sds).
The procedure used by the Italian National Accounts to construct the market production matrix is based on revenue items as surveyed by Sci and Sme surveys, so as to identify goods produced and services supplied by each enterprise. In particular, for small and medium service enterprises the information has been integrated with Sds fiscal data.
This document describes the new methodology that introduces fiscal data to estimate enterprise market production which will be used for the next general revision of national accounts.

Keys words: national accounts, production matrix.

1 Introduction

The system of national accounts is based on an input-output schema defined by supply and use tables [1]. These tables are matrices of homogeneous production branches and kind-of-activity branches that provide detailed descriptions of internal production processes and operations on products in the national economy [2]. In the context of this schema, the production matrix offers a detailed picture of the internal supply of goods and services classified by product and branch. This matrix represents the addition of six matrices concerning three groups of institutional sectors, as differentiated by output destination: for sale (market production), for own final use, free offer or at prices not economically significant (non-market production). The first group concerns financial and non-financial corporations and households as producers - institutional units that do

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not, by definition, produce any goods or services that are free-of-charge or at prices not economically significant - one matrix is constructed for market production and another for own final use. For each of the other two groups - public administrations (P.A.) and non-profit institutions serving households (Isp), on the other hand, one matrix is constructed for market production and another for non-market production and own use.
The objective of this study is to analyse the effects of incorporating enterprises' statistic-based tax assessment - Sector Studies (Sds) - into the methodology used to estimate the market production matrix for financial and non-financial corporations and households as producers, hereafter the "enterprise market production matrix", for the 2011 revision of national accounts.
This fiscal source supplies revenue data for different types of goods produced and services supplied so that they can be integrated with data derived from the structural enterprise studies conducted by ISTAT on an annual basis: the business account survey for enterprises with over 100 workers (Sci), the small and medium sized enterprise survey with less than 100 workers (Sme) and the industrial production survey (Prodcom).

2 The new enterprise market production matrix

The enterprise market production matrix, which will be implemented during the next general revision of national accounts in 2011, is organized into 266 rows, which identify "homogeneous production branches," and 106 columns, which indicate "kind-of-activity branches," i.e., groupings of kind-of-activity units (KAUs) corresponding to the Ateco2007 classification (the Italian version of Nace Rev. 2). "Typical" cells contain the values for "primary production" of the branch, while the remaining cells of each column contain the values for "secondary production," i.e., the production value for atypical goods and services that cannot be distinguished on the basis of enterprise accounting elements or information about their workers in local producer units [2].
The general idea is to construct the production matrix by allocating the output of each branch to the cells of the corresponding column of a base matrix **(*B*)** constructed to stress the secondary output share. This base matrix is constructed using information from the different revenue items of enterprises as registered in the Sci and Pmi surveys in order to identify the output of each enterprise in terms of the goods produced and the various types of services supplied[2]. Considering the enterprise primary business activity is assigned an homogeneous product code to output relating to each of the activity types identified in the accounting data, with reference to the 266 products and 106 activity branches. While the market production of an enterprise may include multiple activity types, only one of these may be for the production of goods. Therefore the total output value of goods is disaggregated using the data from the "Annual industrial production survey" (Prodcom), which details the different products produced over the course of the year by the industrial sector enterprises covered by the survey.
In this context, the most significant methodological innovation with respect to the 2011 benchmark involves greater detailing of the distinction between typical and secondary

[2] Enterprise accounting data gathered by Sci and Pmi allow us to identify 7 different types of activities related to market production: production and transformation of goods; trade, intermediation services; transport; leasing of real estate; other services to third parties; exercise of industrial property rights.

types of service activities. This result was obtained by integrating data from the Sector Studies[3] (Sds) with data from the enterprise surveys. For our purposes, the additional data of these data sources consists in the activity type descriptions that list the revenues for goods produced and services provided by the enterprises for different Sector Studies. Compared with the structural surveys conducted by ISTAT, this administrative source includes greater detail about the different types of services provided by enterprises, although the representativeness is biased towards enterprises with fewer than 20 employees as a consequence of the predefined revenue threshold.

With $\boldsymbol{P}$ representing the enterprise production matrix with 266 lines and 106 columns, k_j representing the typical products of branch j and $n_j=k_1+k_2+\ ...\ k_j$ representing the typical products of branches 1 through j:

p_{ij}, for $i=n_{j-1}+1$, $n_{j-1}+k_j$, is the generic cell of the matrix containing the output value for typical good or service i of branch j, i.e., the value of its primary output;

p_{ij}, for $i<n_{j-1}+1$ and $i>n_{j-1}+k_j$, contains the output value for the good or service i produced by branch j and represents the secondary output for that branch;

$p_{i.} = \sum_j p_{ij}$ is the output value for product i;

$p_{.j} = \sum_i p_{ij}$ represents the total output value (primary and secondary) for branch j;

$p_{..} = \sum_i \sum_j p_{ij}$ represents the total output.

For industrial processing branches and certain services (those not covered by Sds), the value of cell p_{ij} in matrix P is obtained by distributing the output level for branch $p_{.j}$,estimated in accordance with the universe expansion technique, using labour units calculated in terms of full-time equivalent units (FTEs) classified by activity branch and per capita output values from ISTAT's Sci and Pmi enterprise surveys, corrected for under-declaration of value added (“per capita × FTEs”), by using the structure of the base matrix $\boldsymbol{B}$:

$$p_{ij} = p_{.j} \frac{b_{ij}}{\sum_{i=1}^{266} b_{ij}}$$

where b_{ij} is the value of a generic cell in the j-th branch of base matrix $\boldsymbol{B}$.

For services with an informational baseline available from Sector Studies, the value of cell p_{ij} in matrix P is obtained by distributing the output level of branch $p_{.j}$ through the modified base matrix structure $\boldsymbol{S}$ obtained by integrating the data from all of the different Sci revenue entries with the information from Sds:

$$p_{ij} = p_{.j} \frac{s_{ij}}{\sum_{i=1}^{266} s_{ij}}$$

where generic element s_{ij} represents the sum of the output level of the i-product of the j-branch from the Sci survey (g_{ij}) with the one from Sds (d_{ij}) in a coherent manner to the Pmi branch output level ($h_{.j}$)

$$s_{ij} = g_{ij} + h_{.j} \frac{d_{ij}}{\sum_{i=1}^{266} d_{ij}} .$$

[3] The Revenue Agency uses this tool to assess the revenue-generating capacity of individual businesses. These studies followed rigorous statistical procedures that entailed the systematic collection of fiscal data and numerous other "structural" elements characterizing enterprise economic activities (with revenues below a specific threshold) so as to identify a homogeneous clustering for purposes of determining a function for estimating presumed business revenues.

For the data for energy, agricultural, zootechnical and fishery outputs as well as leasing services, since product-side basic data are available, the output $p_{i.}$ is estimated for the total of goods and services irrespective of the activity branches that produced them.
The total estimated output for these goods and services, therefore, constitutes a row constraint. To construct the matrix, this means dividing the $p_{i.}$ estimate between the corresponding cell in branch *j* that produces *i* as its typical product and the other cells in the same row, containing the output of product *i* as produced by the branches for which it represents a secondary activity. The value of the typical product of branch *j*, therefore, is calculated as the difference between the row constraint and the cells in the same row that have already been determined

$$p_{ij} = p_{i.} - \left(\sum_{i=1}^{j-1} p_{ij} + \sum_{j=j+1}^{106} p_{ij}\right),$$

by $i = n_{j-1}+1, n_{j-1}+k_j$. Since it is not a "predetermined" value, the total output for the activity branch is calculated a posteriori by adding the values of the different cells in the corresponding column.

3 Considerations

The incorporation of Sds into the estimation of the enterprise market production matrix represents an important qualitative improvement to identify the different activities connected with services. For enterprises with primary activities in the service sector, the accounting data from the enterprise surveys identifies activity types don't permit to capture the secondary production of services other than trade, transport or intermediation. In addition, these surveys have coverage levels that are relatively modest for this particular production sector, which tends to be dominated by small- and medium-sized enterprises. The integration of the Sds source has satisfied a simultaneous need for a better differentiation of services activities and a higher rate of representativeness for the small- and medium-sized enterprises in the Italian National Account.

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Fifty Years of Italian Sampling and Economic Cycle History witnessed by the Business Confidence Survey on Manufacturing Sector

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Abstract The globalization of economy requires a steadily increasing demand for statistical information. Unification political processes and the establishment of international institutions are among the events which have contributed to such increase during the last decades. The evolution of the Business Confidence Survey on manufacturing sector is presented starting from the preliminary European project for harmonised statistics launched in the late fifties of the last century. Survey changes are described, focusing in particular on the so-called *confidence indicator*. The continuing increase of statistical accuracy in sampling is recalled, from the initial purposive sample and controls up to the present state of the art. Specific attention is devoted to the role of administrative archives in the sampling plan. Emphasis is also given to the increasing use of computer simulation in assessing the validity of the estimates. The role of cyclical analysis is finally highlighted with regard to two aspects: (i) the business confidence has not a corresponding variable in the economic system - the validation can only be performed in comparison with correlated variables (e.g. IP, GDP); (ii) confidence shows forecasting capability for the economic system

Keywords: Business Tendency Surveys, Administrative Archives, Confidence Indicators, Leading Indicators, Cyclical Analysis, Simulation.

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1 The Harmonised BCS: History and Characteristics

The survey on the manufacturing sector in Italy is part of the Joint Harmonised Business and Consumers Survey (BCS) program of the European Commission which presently covers manufacturing, construction, retail trade, services sectors and consumers in all the member countries.

"The principle of harmonization underlying the project aims to produce a set of comparable data for all European countries" (EC, 2006). To achieve this goal institutes have to respect two basic principles recommended by the European Commission, namely: (i) to use the same harmonised questionnaire; (ii) to strictly respect the Commission timetable in carrying on the survey and transmitting the results. Institutes instead are let relatively free of defining the other aspects of the entire process from the data collection to the sample design (apart from a required minimum sample size) and processing techniques. They are however invited to respect the recently developed EC-OECD guidelines (EC, 2006; OECD, 2003).

The BCS aims to investigate the *confidence* of the economic operators by asking entrepreneurs and managers on current trends and expectations for the near future, regarding both their own business and the general situation of the economy. Information collected is of a qualitative type, mainly with a three-option ordinal scale, whose values (e.g. above normal, normal, below normal or: high, normal, low) have a unique order, that is they may be sorted into a ordered sequence without any ambiguity. Moreover, possible answers are always presented alongside with the "I don't know/non-response" option, In some restricted cases, for variables that are not reported in conventional statistics, information collected is quantitative: percentages of capacity utilization or the number of months of production assured.

Answers obtained from the survey are aggregated in the form of *balances* that is as differences between positive and negative answers. Balances are then used to build the *confidence indicator* as arithmetic mean of three series: level of orders, production expectation and stocks (with inverted sign). The general idea behind the construction of such an indicator is that each survey answer contains a common component which can be better extracted by a cross-sectional average. The series stemming from the monthly information represent a valuable tool for cyclical analysis and for building leading indicator of the industrial production and the GDP.

The survey has a very long history. ISCO (in 1999 merged in ISAE and in 2011 in ISTAT) was among the three Institutes (with IFO for Germany and INSEE for France) which started this project in 1959, on a quarterly basis. The survey became monthly-based in 1962 on a limited number of questions (ISCO, 1961). The project continued over the years according to the European guidelines and progressively upgrading the sampling techniques and the sampling design. Since 1988 the data collection mode gradually shifted from ordinary mail to telephone, assuring more up-to-date results. The data processing received two main revisions, in 1986 and in 2002 (Malgarini, Margani, Martelli, 2005), whereas the weighting system based on internal and external weights at stratum level was introduced according to OECD (2003) guidelines.

2 Sampling design

At the beginning the survey was conceived as a purposive panel of *leading firms*. Through this definition, only enterprises which gave some particular innovative contribution to the growth of industrial sectors were considered (Martelli, 1998). The unit selection criteria were therefore mainly discretional with low reliability in the estimates. Over the time, with the increasing use of computational methods, a first thoroughly stratification re-designing of the sample was performed in 1986 - adopting a proportional allocation - which allowed an estimation of regional outcomes (Pinca, 1990). In 1998 an optimal allocation according to Neyman by sector and size was adopted (Martelli, 1998). Only recently researchers have dealt with computational methods and simulations specifically in the field of sample allocation (Chiodini et al. 2010b). In a recent work of Chiodini et al. (2010a) this allocation has been compared to other allocation methods, such as the Bethel multivariate allocation, the uniform and the proportional allocations, together with a novel method, namely the Robust Optimal Allocation with Uniform Threshold method, in order to re-think the allocation method to be used in a near future. New computer-driven strategies for simulation (when methods and estimate performances have to be simultaneously compared) are beginning to be used. For example, Chiodini et al. (2010b) used a method called *Sequential Selection-Allocation*, which is a sequential process to empirically evaluate the performance of the various sampling allocation methods. In fact when the availability of real data is scarce (and this is the case when comparing different scenarios) only computational power can support the empirical evidence.

Cyclical analysis as validation and economic investigation tool

When considering the way the business surveys questions are posed, the resulting indicators are likely to represent a deviation from a "normal level". This makes uncertain to assess what is the quantitative counterpart of the qualitative surveys. In this section a brief analysis is presented about the cyclical properties of the business confidence indicator with reference to various transformations of the industrial production index. Indeed, the question we are trying to investigate is whether the business cycle features of the confidence indicator are more related to the concept of *classical, deviation or growth cycle* of the quantitative indicator. The first defines a recession as a decline in the absolute level of a series, the second as a decline in the detrended series, the third as a decline in the growth rate series. In all the cases the routine proposed by Bry and Boschan (1971) is used to identify expansion and recession phases. As for the classical cycle, business cycle phases are identified directly on the industrial production index. As for the deviation cycle, turning points are identified on two kinds of cycles extracted, respectively, with a Butterworth filter and the Hodrick-Prescott filter. The reason for using two methods is that the detrending operation can have a significant impact on turning point detection, due to the different features of the filters used. The filters used here are two low-pass filters for trend estimation, based, respectively, on Pollock (2000) and Hodrick and Prescott (1997). In both cases a series is considered as composed by a trend and a cycle component. The filter estimates the trend, and the residual, i.e. the cycle is considered in the analysis.

The growth cycle series considered is the seasonal difference of logs of industrial production. Business cycle phases are represented as binary series, with 1s' representing an expansion and 0s' representing a recession. The relation between the business cycle of the confidence indicator and those of the various transformations of industrial production index are examined with the correlation coefficient, also considering some lagged relationships.

Table 1 reports the main results: the correlation coefficient is reported both for the contemporaneous case as well as for the lead/lag presenting the maximum value. The main facts seems to be: 1) correlation increases passing from the classical cycle to the growth cycle, with the deviation cycle somewhat in the middle; 2) in general there is a lead of business phases for the confidence indicator over the classical cycle and, on a lesser extent, over the deviation one.

Table 1: Correlation between business cycle phases with respect to that of the confidence indicator

	Level	**Butterworth**	**Hodrick-Prescott**	**Seasonal Δ of logs**
Correlation at 0	0.210	0.338	0.286	0.487
Max correlation (lag)	0.353 (8)	0.417 (5)	0.321 (2)	0.487 (0)

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Since 1861 up to 2011: the evolution of the population census informative contents

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Abstract The population census plays a central role in official statistics systems by providing a reliable counting of the population at the national and smaller territorial levels, as well as the population distribution by sex, age and other demographic, social-economic characteristics. Over the years, census faced changes that involved modern societies and new informative needs of stakeholders and policy makers. A few months before the 15th Italian general population census, there are many expectations related to the topics included and to the timely final data dissemination. The paper discusses some issues around the evolution of the informative contents since 1861 up to 2011 and gives the opportunity to analyse the developments in terms of variables, definitions and breakdowns.

Key words: Census, Informative contents

1. Enumeration units

In Italy the Population Census was carried out for the first time in 1861, the year of the birth of the Italian Kingdom. It is conducted every ten years, with the exception of 1891 (when the census was not carried out because of an economic crisis) and 1941 (year in which Italy was involved in the 2nd World War); the 8th census (1936) represents the only case of the universal enumeration 5 years after previous.
Enumeration units of population census are: Private households and Institutional households. Since 1951, contextually to the population census, the housing census has been conducted; anyway the present work focuses only on the enumeration unit "private household".
In the first two censuses, household was generically defined on the concept of living together (life in common) so, since this concept was valid both for private and

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institutional households, no distinction was made between them. In the 3rd census the distinction between private household and "social household" was established. In the first censuses of the last century, the "census household" began to take shape the common concept of two or more persons united by blood ties or kinship and living together. From 1951 to 1981, private household was defined on the basis of usual living together (with a common economy, although limited only to nutrition) besides that of cohabitation. In the 1991 census, the pooling of income by individual components faded. So, for the census purpose, starting from 1991, private household is defined as "a group of people united by marriage, blood ties, kinship, adoption, guardianship or by emotional bond, cohabiting and having usual residence in the same municipality (even if not yet booked in the population registers of the same municipality)".

2. Enumeration forms and informative contents

The 1861 "Census form" was extremely brief, made up of a single sheet by which only few information was asked. Already in 1871 the form includes two sheets, with "explanations and instructions" for the correct filling and some warnings about the response compulsoriness and the census relevance. In 1911 questionnaires changed with the aim of collecting information in order to update population registers. Over the years census forms become more and more complex; the demographic and social-economic structure of the country undergoes modifications and to take a picture of the reality it is necessary to arrange forms able to catch all the facets of a constantly evolving society.

In 1961 the enumeration form is divided into sections, innovation that 50 years later remains one of the feature of the census questionnaires of the new millennium. The adaptation of the information contents to the changing socio-economic context of the country has been one of the strategic purpose in the design of forms for the first census of the twenty first-century. It acknowledged the needed of stakeholders; new questions were included, others were changed, taking care to contain burden on respondents.

As for any other survey, the quality of census results strictly depends from the adopted enumeration form. From a census to another, the number of variables has increased, considered the enhanced informative requirements and the progress of technology that allows larger, faster and safer processing. Nevertheless more than a question has been removed because, for example, the experience showed a low reliability of the data.

The questionnaires carried out for the 15th census of population have been streamlined in the name of simplification where previous experience had not provided the desired results in terms of quality of information collected and, simultaneously, enriched with new topics to meet the requirements of European legislation. One of the main features of the 2011 Italian Census strategy will be the use of sampling techniques for the collection of socio-economic information. This strategy implies the adoption of two household forms. The longest includes more than 80 questions for each member; both questionnaires ensure international comparability.

3. Demographic characteristics

A first group of questions, almost unchanged over time, was already present in the 1861 census form. It deals with questions regarding personal information such as sex, marital status, place of birth (except 1936), citizenship (since 1881), and relationship to the head of the household (become in 1991 "relationship to reference member of the household").
To obtain information on age, in the first censuses it has been required "age in completed years" whereas information on date of birth is collected from 1921.
About the place of birth, till 1971 information was collected on municipality and province in which the birth took place and, for persons born outside the country, on the country of birth. Since 1981, the respondent has to answer if he/she was born in the same municipality of usual residence, in another municipality (specifying municipality and province), or outside Italy (specifying the country of birth).
A topic essential for identifying family nuclei and private households of various types, considered as question on personal characteristics, is the "relationship to the head of the household" (changed in "relationship to reference member of the household" in 1991). This topic is present from the first census, even if categories have been gradually increasing.
Also the topic on legal marital status changed with the introduction, little by little, of new categories. So, in 1991, the category "de facto separated" is included and the date of legal marriage (current marriage) is required. In 2001, in order to investigate on "reconstituted family" it is also collected information on the marital status before the current marriage. The questions on marital status remain unchanged for 2011.
Traditionally, census lets to obtain useful information on foreign population. For foreign usually residents there are, from 1881, all the information collected for the Italian population. The foreigners' enumeration has become a very complex and delicate question, on one hand for the presence of "irregular" people, led to consider the census as a "police" operation, and, on the other hand, for the difficulty of communication between the survey staff and the foreigners who do not speak our language. At the 2001 census, the foreign resident in Italy is a person who has his usual residence in Italy and has the requirements for being booked in the municipal population register (as regards non-EU foreign people, in addition to usual residence, the requirement for being booked in the population register is the permit to stay). Moreover, to facilitate the questionnaire filling, a facsimile of the form was translated into 11 languages. The growing presence of foreigners on Italian territory has led to increase the number of questions related to citizenship, by collecting also information that allows to identify additional groups with, directly or indirectly, foreign background. Therefore, new topics have been included in the form on Italian citizenship by birth or acquisition, on the year and the main reason of immigration in Italy (only for foreign and stateless persons born abroad) and, for 2011, also on the country of birth of parents.

4. Socio-economic characteristics

Educational characteristics. As far as the educational attainment is concerned, till 1931 only information on the ability to read and/or write was collected; in 1951, for the first time data referring to the highest level successfully completed in the education system of the country were collected, allowing consistent statistics on the educational features of the population. Since 1971 the question has been designed foreseeing few categories and living space for filling a description of university and upper secondary degrees. The purpose was to obtain a more detailed enumeration of educational characteristics together with a reduction of the coding activity carried out by municipalities. In 1981 the item on the attendance of the pre-primary school has been included. The percentage of mothers-worker increases as well as daycare centers for children under six. In 1991, in confirmation of the upward trend of female employment, there is also the question about the attendance of daycare centers for children under three.

In 2001 pages of the household forms devoted to educational characteristics were redesigned in order to face changes in the Italian Educational System and the increase of foreign usually residents in our country. For the topic "educational attainment" 16 categories were proposed; questions about the highest level successfully completed in Italy or abroad and about the duration of the programme were included: the aims were to identify Italians who studied abroad and to establish the appropriate level/grade equivalence for persons who received their education under a foreign system.

For the 15th Italian general population census the strategy will remain almost the same. Few differences will pertain additional categories for the educational attainment, new questions about the second stage of tertiary education and the completion of a level provided outside schools and universities.

Economic characteristics. Since 1861 topics concerning economic characteristics of persons have been collected. On the first census round of the Italian Kingdom, only one question about occupation was included; in 1881, in case of more than one job, persons had to describe "first the occupation that provides the majority of sustenance, then the less important one". In 1911, each household member had to specify the "main occupation" or the "collateral one" or, as an alternative, it was necessary to indicate if the person was «well-off, retired, student, homemaker, detainee, patient»; this breakdown is similar to the one currently adopted to classify the not economically active population. In 1931 information on industry and status in employment was collected and, starting from 1951, classifications were improved to ensure international comparability and an high level of data quality.

In 1991, two questions about occupation were asked in order to obtain more precise information on the type of work done in a job. However this methodology hasn't been repeated due to the high costs related to the coding activity. In 2001 the complex transformation of labor market and the needs of international comparability imposed a deep revision of the household form. The number of topics slightly increased and some definitions changed. The enumeration strategy of economic characteristics of persons planned for 2011 is not very different than the last census. Anyway, new breakdowns have been adopted and new questions have been included in the questionnaires also to comply with the European Regulations on population and housing censuses.

The Unity of Italy from the point of view of student performances: evidences from PISA 2009

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Abstract This paper investigates Italian student performances based on the 2009 edition of the Programme for International Student Assessment (PISA), a survey conducted by OECD in order to assess skills of 15-year-olds in schools with respect to reading, mathematical and scientific literacy. In particular, student outcomes are compared among different Italian regions, taking into account socio-economic background and school membership of students. The results show that, despite the existence of a unified educational system in Italy, regional differences are evident. However, taking the nested structure of data into account, it can be shown that the most part of the variability in student performances can be explained by differences at school level.

1 Introduction

The anniversary of 150 years from the Unity of Italy is an occasion for taking stock of the Italian situation by different points of view. In particular, the study of territorial differences, continuously pointed out at economic, social and cultural level, assumes a particular importance.

In the educational field, performance gaps among the different areas of the country are observed regularly. National assessments, conducted by the National Evaluation Institute for the School System (INVALSI) at different school levels, reveal that geographical differences are evident with respect to Italian language and mathematics both in primary and lower secondary school (INVALSI, 2010a; 2010b). In particular, students in the North of Italy usually outperform students in the Centre, and the most worrying deficiencies are observed for students living in the South of the country.

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Moreover, results of Northern regions are rather similar while the variability in performances of Southern regions is considerable, both within and between regions. These results are generally confirmed also by international surveys.

Territorial gaps in learning and competencies mean not only a difference in the effectiveness but especially in the equity of the scholastic system, producing as a consequence economic and social costs. For this reason, these issues should be seriously taken into account by policy makers and some projects have already been developed in cooperation with the European Union to support the Southern regions of Calabria, Campania, Puglia and Sicilia through the National Operational Programmes (PON projects). Territorial differences in learning are not isolated; in fact gender, social strata and school gaps are present as well.

The study of student performances in secondary education should be conducted by taking into account the different types of upper secondary schools. In fact, three main types of school are present (academic, technical and vocational) which involve a different rate of students in different territorial areas. As can be seen in Table 1, the relative majority of students choose an academic track (liceo), especially in the Centre and in the Southern part of the country. On the other hand, the North-East is characterized by highest rate of students in technical or vocational schools.

Table 1: Percentage distribution of Italian students by geographical area and type of school for the scholastic year 2009/2010 (Source: Ministero dell'Istruzione, dell'Università e della Ricerca)

Area	***Academic***	***Technical***	***Vocational***
North-West	44.0	34.2	21.8
North-East	39.8	37.3	22.9
Centre	49.4	30.2	20.4
South	46.7	30.5	22.8
Islands	47.9	30.3	21.8

The aim of this work is to understand which picture of the territorial uniformity emerges from the last international student assessment conducted in Italy: the OECD PISA 2009. The question then is: is Italy a unified country from the point of view of student performances? Also, does the scholastic system show the same limits and potentialities in all geographical areas? These issues are explored also taking into account the nested structure of data in order to understand how much of the variability in the performances can be imputed to geographical differences and to the school effect.

The paper is organized as follows. In section 2, a description of the OECD PISA survey is given, with details on the Italian case while in section 3 the main results on the Italian student performance are presented. Section 4 is devoted to the multilevel analysis of data and section 5 addresses concluding remarks.

2 Features of the OECD PISA survey

The Programme for International Student Assessment (PISA) is a standardized survey conducted by the Organization for Economic Cooperation and Development (OECD) and developed by participating economies.

The main aim of PISA is to assess reading, mathematical and scientific literacy of 15-year-olds in schools at international level. In particular, students near the end of compulsory education are evaluated not merely in terms of curricular contents but taking into account important knowledge and skills needed for full participation in society in adult life. To this end, students are expected to use their knowledge and capabilities in facing a wide range of texts and problems, not necessarily belonging to their scholastic or familiar experience (OECD, 2009b).

The idea underlying PISA is that the literacy level could be an indicator of the social capital and a predictor of socio-economic welfare of single individuals and countries. For this reason, the survey is assuming an increasing importance for comparative purposes at international level and longitudinal perspective.

The survey started in 2000 and it is renewed every three years. For each edition, all three literacy domains are assessed but only one is privileged (reading in 2000 and 2009, mathematics in 2003, and science in 2006). Furthermore, student engagements and strategies are investigated, and information about schools, parents and socio-economic background are collected as well. The available information about students allow not only to evaluate the performances related to the three different domains, but also to study the relationship between the performances and the characteristics of students, schools and the whole system.

In PISA 2009 (see OECD, 2010), 75 countries were involved in the assessment, among which there are 34 OECD countries and 41 partners. OECD estimated that about nine-tenths of the world economy are represented by the participating countries, which cover the 2/3 of the world population.

By using data on item responses, standardized literacy scales are constructed for each domain having a mean value of 500 and a standard deviation of 100. The methodology underlying this process is *item response theory* (Lord and Novick, 1968; Hambleton and Swaminathan, 1985). In particular, the mixed coefficients multinomial logit model (Adams, Wilson, and Wang, 1997) is used in order to set item difficulty and student ability on the same scale. The computation of the student individual score involves the concept of plausible values, which are simply random draws from the posterior distribution of ability. For each student, five plausible values are reported, which should be taken into account when computing score statistics. As a second step, literacy scales are divided into levels, i.e. proficiency levels, representing increasing item difficulties and student abilities. Proficiency levels can be used to classify students not only according to their score, but also describing what they can do in practice within each ability domain. All features described above make PISA one of the most important international surveys in the field of student assessment.

In Italy, the edition of 2009 was characterized by the presence of a representative sample for all regions and the two autonomous provinces of Trento and Bolzano. Even if Italy has a single scholastic system, the availability of regional data is motivated by the decentralization process sanctioned by the 2001 constitutional reformation and it represents an important source of information for studying the school gaps in different territorial areas of the country.

The PISA sample is a two-stage stratified sample, where the first-stage sampling units consist of individual schools having PISA eligible students (sampled with probabilities proportional to the school dimension) and the second-stage sampling units are students within sampled schools. For each school, a sample of 35 students was selected. The stratification design was planned so that reliable estimates could be obtained not only at national level, but also by school type and by regions.

Table 2: Number of students and schools in the PISA 2009 Italian sample and student distribution by school type (weighted percentages)

			School type				
	N. students	***N. schools***	***Academic***	***Technical***	***Vocational***	***Lower secondary***	***Vocational training***
Italy	30905	1062	43.0	30.1	22.1	1.5	3.4
Abruzzo	1450	50	49.3	31.9	16.1	2.1	0.6
Basilicata	1530	52	45.5	30.2	24.3	0.0	-
Bolzano	2144	81	30.6	24.4	12.0	4.2	28.9
Calabria	1483	52	49.1	27.9	21.9	1.1	-
Campania	1431	50	48.2	27.9	22.8	1.1	-
Emilia-Romagna	1494	51	37.8	33.6	23.8	0.0	4.9
Friuli Venezia Giulia	1576	55	43.0	27.7	24.6	3.0	1.7
Lazio	1462	52	53.0	24.6	19.4	1.0	1.9
Liguria	1427	49	40.2	31.3	24.1	1.0	3.4
Lombardia	1512	52	36.7	33.3	21.9	1.5	6.7
Marche	1512	50	39.2	34.2	26.1	0.5	-
Molise	1209	44	45.9	35.2	17.9	1.0	0.1
Piemonte	1518	50	36.5	30.9	24.6	2.8	5.2
Puglia	1497	48	45.6	29.8	24.6	0.0	-
Sardegna	1416	51	47.7	34.6	15.6	2.1	-
Sicilia	1333	49	47.7	26.9	21.8	3.4	0.2
Toscana	1444	50	43.8	31.9	22.4	1.8	-
Trento	1449	50	40.1	26.8	10.5	0.5	22.2
Umbria	1562	54	45.4	28.5	23.5	0.8	1.7
Valle d'Aosta	879	22	48.8	13.7	32.2	1.0	4.3
Veneto	1577	50	31.7	32.7	22.7	1.5	11.4
North-West	1577	50	31.7	32.7	22.7	1.5	11.4
North-East	5336	173	37.1	32.2	23.0	1.8	5.9
Centre	8240	287	35.3	31.7	22.0	1.2	9.8
South	5980	206	47.9	28.3	21.5	1.2	1.1
South-Islands	5587	192	47.3	29.2	22.6	0.8	0.1

The final Italian sample consisted of 1,097 upper and lower secondary schools (only 1.5% of lower secondary) and 30,905 students. Besides the regional stratification, a further territorial aggregation can be considered in Italy, dividing the country into 5 main geographical macro-areas: North-West (Piemonte, Lombardia, Liguria and Valle d'Aosta), North-East (Veneto, Friuli Venezia Giulia, Trento, Bolzano and Emilia-Romagna), Centre (Toscana, Lazio, Umbria and Marche), South (Abruzzo, Molise, Campania and Puglia) and South-Islands (Calabria, Basilicata, Sicilia and Sardegna). Table 2 shows the number of students and schools involved in PISA 2009, together with the distribution of students by school type. As can be easily noticed, the relative majority of students are in an academic school (liceo), with the only exception of the region Veneto. Also, in the same region and in the two autonomous provinces of Bolzano and Trento, a notable part of the student sample belongs to training schools (formazione professionale).

3 Main results of PISA 2009 in Italy

The most immediate and evident result from the last edition of the OECD PISA is that the overall performance of Italian students is statistically significantly lower than the OECD average in all the three domains of reading, mathematics and science. However, looking at the results within the single geographical areas and regions, shown in Table 3, the situation appears rather different.

In the reading scale, students of North-West and North-East obtain a mean score significantly higher than the Italian average and the OECD average, while students in the South and South-Islands achieved the worst results, significantly lower than both the Italian and the OECD mean score. The Centre of Italy obtains intermediate performances, with a mean score close to the Italian mean but statistically lower than the international mean. Exactly the same conclusions can be drawn looking at the results for the mathematical and scientific literacy scales.

At a regional level, the top performing regions are Friuli Venezia Giulia, Lombardia, Veneto and Trento for all domains but all regions in Northern Italy obtain rather satisfying scores, at least close to the Italian and the OECD mean. When looking at the Southern part of the country, the results are significantly below the Italian and the OECD mean, with the exceptions of Abruzzo and especially of Puglia.

When comparing geographical macro-areas with each other, as depicted intuitively in Figure 1 for the reading scale, it can be seen that students in the North outperform students in the Centre and in the Southern area of the country.

Exactly the same results are observed for the remaining domains, with a single exception on the science scale, where the mean score of students in the South is not statistically significant different from the score of their colleagues in the South-Islands.

Table 3: Mean score in student performance on the reading, mathematics and science scales

	Reading		***Mathematics***		***Science***	
	mean	*s.e.*	*mean*	*s.e.*	*mean*	*s.e.*
OECD	493	0.5	496	0.5	501	0.5
Italy	486	1.6	483	1.9	489	1.8
Abruzzo	480	4.8	476	6.7	480	5.7
Basilicata	473	4.5	474	4.4	466	3.9
Bolzano	490	3.2	507	3.2	513	2.5
Calabria	448	5.2	442	5.1	443	5.5
Campania	451	6.6	447	7.8	446	6.8
Emilia-Romagna	502	4.0	503	4.7	508	4.8
Friuli Venezia Giulia	513	4.7	510	4.6	524	4.8
Lazio	481	3.9	473	5.5	482	5.0
Liguria	491	9.3	491	9.3	498	9.9
Lombardia	522	5.5	516	5.6	526	5.8
Marche	499	7.3	499	4.5	504	6.5
Molise	471	2.8	467	2.7	469	2.8
Piemonte	496	5.9	493	6.0	501	5.2
Puglia	489	5.0	488	6.9	490	6.3
Sardegna	469	4.3	456	5.2	474	4.5
Sicilia	453	8.3	450	8.8	451	8.2
Toscana	493	4.5	493	5.4	500	5.7
Trento	508	2.7	514	2.5	523	3.6
Umbria	490	5.3	486	4.1	497	5.0
Valle d'Aosta	514	2.2	502	2.3	521	2.6
Veneto	505	5.2	508	5.6	518	5.1
North-West (N-W)	511	3.9	507	4.0	516	4.0
North-East (N-E)	504	2.8	507	2.9	515	2.8
Centre (C)	488	2.6	483	3.2	491	3.0
South (S)	468	3.9	465	4.8	466	4.2
South-Islands (S-I)	456	4.8	451	5.1	454	4.8

Figure 1: Matrix of multiple comparisons of mean score in reading literacy by Italian geographical macro-areas

			N-W	**N-E**	**C**	**S**	**S-I**	**Italy**	**OECD**
		mean	511	504	488	468	456	486	493
	mean	s.e.	3.9	2.8	2.6	3.9	4.8	1.6	0.5
N-W	511	3.9		=	+	+	+	+	+
N-E	504	2.8	=		+	+	+	+	+
C	488	2.6	-	-		+	+	=	-
S	468	3.9	-	-	-		+	-	-
S-I	456	4.8	-	-	-	-		-	-

Note: read across the row to compare a geographical area’s score with the score of each geographical area listed in the column heading (symbol “+” means a statistically significantly higher score, “-” a statistically significantly lower score and “=” no statistically significant difference).

Figure 2: Geographical distribution of the *top* performer percentage in reading literacy

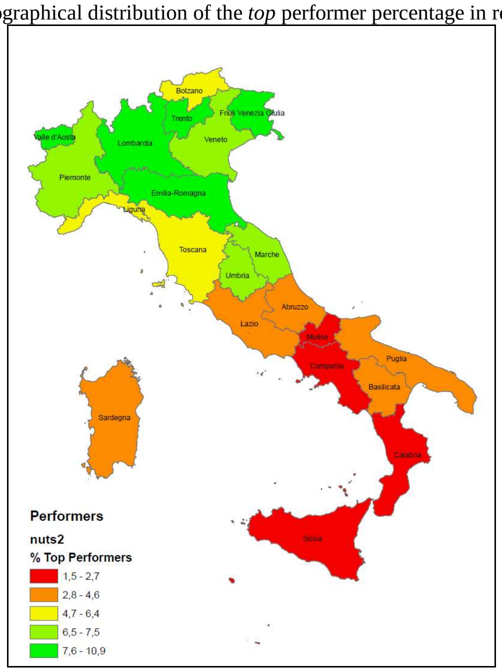


Figure 3: Geographical distribution of the *low* performer percentage in reading literacy

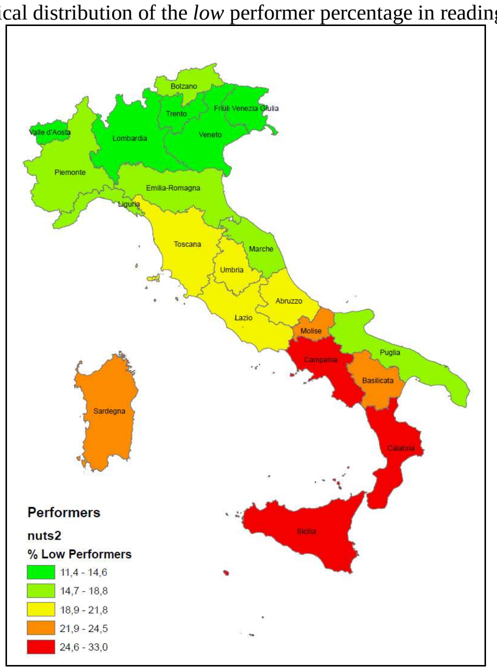


Table 4: Mean score in student performance on the reading scale by school program.

	Academic		***Technical***		***Vocational***		***Vocational training***	
	mean	*s.e.*	*mean*	*s.e.*	*mean*	*s.e.*	*mean*	*s.e.*
Italy	541	2.2	476	2.7	417	3.8	399	6.2
Abruzzo	533	6.4	449	5.0	409	11.3	349	31.0
Basilicata	524	4.7	457	5.9	398	11.1	-	-
Bolzano	558	2.3	512	3.2	452	4.3	432	4.0
Calabria	505	5.4	409	7.6	377	15.3	-	-
Campania	509	7.3	414	10.2	377	15.4	-	-
Emilia-Romagna	576	3.5	498	4.6	423	12.1	348	24.7
Friuli Venezia Giulia	573	4.3	510	7.3	434	9.7	407	7.7
Lazio	530	5.0	453	6.5	402	8.9	348	7.8
Liguria	546	4.7	484	6.8	424	41.8	410	25.7
Lombardia	577	8.2	526	8.7	470	11.0	391	11.7
Marche	560	5.7	498	6.1	409	14.0	-	-
Molise	516	3.7	452	3.6	397	5.5	375	45.1
Piemonte	563	9.6	503	4.5	418	7.7	432	4.0
Puglia	535	7.2	480	7.5	416	12.9	-	-
Sardegna	525	5.0	443	4.5	370	10.7	-	-
Sicilia	515	11.6	432	10.5	379	15.0	433	10.0
Toscana	553	4.5	485	8.1	394	9.9	-	-
Trento	571	4.0	509	3.7	471	17.3	415	8.8
Umbria	554	5.6	468	10.8	407	11.9	379	39.0
Valle d'Aosta	559	3.0	513	6.2	463	4.0	423	8.9
Veneto	562	6.8	512	7.8	481	11.8	404	14.0
North-West (N-W)	569	5.6	516	5.9	449	8.2	403	9.3
North-East (N-E)	569	3.1	507	4.0	453	7.6	400	9.3
Centre (C)	541	2.9	472	4.3	401	5.7	351	8.6
South (S)	521	4.5	443	5.8	395	9.7	350	29.8
South-Islands (S-I)	515	6.7	431	5.6	379	8.9	433	10.0

With respect to the distribution of students among the proficiency levels, what should be highlighted is the rate of low and high performers, defined by OECD, 2011. Low performers are those students who do not attain the PISA baseline proficiency Level 2 in reading, at which the student is asked to determine the main idea of a text, understand relationships or infer meaning when the information is not prominent. High performers are those students who attain proficiency Level 5 or above, at which students must have a full and detailed understanding of a text whose content or form is unfamiliar.

The regional distribution of the top performer percentage is shown in Figure 2. The highest percentages of top performers are present in Northern regions, where Emilia-Romagna, Friuli Venezia Giulia, Lombardia, Valle d'Aosta and Trento exceed 7.6%. On the other hand, Calabria, Campania, Molise and Sicilia show very low percentages of top performers.

Figure 3 shows the regional distribution of low performing students. What can be easily noticed is that the number of low performers is worrying in the Southern regions and particularly for Calabria, Campania and Sicilia with more of the 30% of cases. These regions show the most critical situation with respect to both the lack of excellent students and the presence of students who do not attain the baseline proficiency. On the other hand, the smallest percentages of low performers are present in Friuli Venezia Giulia, Lombardia, Valle d'Aosta, Veneto and Trento.

As already discussed in Section 1, an important variable to be considered in the analysis is the type of school. Table 4 reports the mean score in the reading scale by school type distinguishing by Italian geographical areas.

By conditioning for school type, the ranking of the Italian macro-areas remain unchanged. In fact, the Northern areas got the highest results within each school program, while the Southern regions got the worst.

Another particularly important variable to be considered is the ESCS (economic, social and cultural status) index, due to its strong relation with student performances demonstrated by several international researches. The ESCS scores are obtained as component scores from a component analysis with zero being the score of an average OECD student and one the standard deviation across equally weighted OECD countries, where variables taken into account are derived from the student report (highest occupational status of parents, higher parental education expressed in year of schooling, and home possessions as a proxy indicator of family wealth). In the second column of Table 5 the ESCS mean is shown for Italy and the geographical macro-areas. Only the Centre is associated to a positive value of ESCS, meaning that on mean the socio-economic background is higher in this area than in the rest of Italy. This result was also confirmed by the computation of quartiles (not shown here). Northern regions have negative values but quite close to zero while the Southern regions present largely negative values, meaning that they suffer from an unfavourable background. When looking at the mean score on the reading scale in the quarters derived by national quartiles of the ESCS index, it can be noticed that, ESCS ranges being equal, the students in the North, and especially in North-West, outperform students in the Centre and in the South, where Southern-Islands students get the lowest scores.

Table 5: ESCS mean and mean score on the reading scale based on ESCS national quartiles.

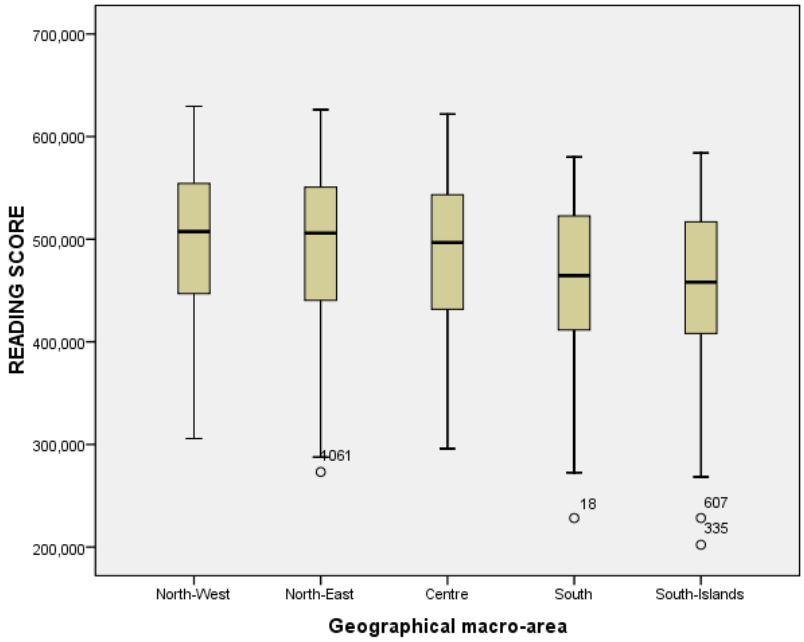
	ESCS		***Lower quarter***		***Second quarter***		***Third quarter***		***Upper quarter***	
	mean	*s.e.*	*mean*	*s.e.*	*mean*	*s.e.*	*mean*	*s.e.*	*mean*	*s.e.*
Italy	-0.12	0.01	441.47	3.01	477.53	2.03	500.51	1.98	526.01	2.14
North-West	-0.06	0.02	464.86	5.56	497.98	5.49	524.84	4.93	548.67	4.50
North-East	-0.03	0.03	457.61	5.33	490.15	3.63	515.31	2.70	546.01	3.84
Centre	0.08	0.03	442.08	4.23	473.57	4.61	499.77	3.25	514.45	3.82
South	-0.32	0.03	436.40	5.82	468.79	4.35	481.26	4.40	507.32	4.79
South-Islands	-0.25	0.04	416.44	8.21	452.88	4.95	469.56	4.86	503.16	6.49

4 A multilevel analysis

The analyses shown in the previous section gave an overview of regional differences in student achievements, taking into account also school type and socio-economic and cultural background. The mean score on the reading, mathematics and scientific scales can be considered as a measure of effectiveness both at a country and at a regional level.

However, it is well known that much of the variability in student performances can be imputed to school differences (see OECD, 2009a, chapter 15) and this aspect deserves a special attention because it is involved with the concept of the system equity. Figure 4 shows the distribution of mean scores on the reading literacy obtained by schools in the five Italian macro-areas. As can be seen, the geographical differences are still present when schools are taken as observations. In fact, schools in the North are associated to a higher mean score with respect to Centre and especially to the South and South-Islands. Furthermore, there is a noticeable variability between schools within the same area (standard deviations range from 69 to 74 PISA score points).

Figure 4: Boxplots of mean score on the reading literacy obtained by schools in different geographical macro-areas



In order to take into account the hierarchical structure of data coming from the PISA survey, we resort to multilevel analysis (Goldstein, 1995; Snjiders and Bosker, 1999; Bryk and Raudenbush, 2002). When data are nested, it is likely that the average correlation between variables measured on observations in the same group will be higher than the average correlation on observations belonging to different groups. For this reason, multilevel models, overcoming the assumption of independence among observations typical of ordinary regression, should be adopted in order to provide reliable and unbiased estimates of linear relationships between variables of interest in the population.

As pointed out in OECD (2009a), the use of linear models without taking into account the way in which students are assigned to schools may provide an incomplete or a misleading representation of efficiency in education systems. On the other hand, multilevel models allow the evaluation of the relative variation in the outcome measures, between students within the same school and between schools. Moreover, when considering a third hierarchical level (e.g. geographical areas or countries) the total variability can be decomposed further.

Firstly, we focus on two-level modelling, considering students as first-level observations and schools as second-level observations. The first step in multilevel analysis is to estimate the so called "empty model", which does not include covariates, and it is equivalent to conduct a mixed analysis of variance. Denoting by Y_{ij} the reading score of the *i*-th student belonging to the *j*-th school, where $i=1,...,I$ students and $j=1,...,J$ schools, the empty model can be defined as follows

$$Y_{ij} = \gamma_{00} + u_{0j} + \varepsilon_{ij} \,, \qquad (1)$$

where γ_{00} is the overall intercept, since $\beta_{0j}= \gamma_{00}+u_{0j}$ is the random intercept for school *j*, u_{0j} is the between school error representing the school departure from the overall intercept, and ε_{ij} is the within group error representing the student *i* departure from the mean score of school *j*. The variance of the school error (between variance) is $V(u_{0j})=\tau_{00}$ while the variance of the student error (within variance) is $V(\varepsilon_{ij})=\sigma^2$. By decomposing the total variance into the group and the residual variances, the intraclass correlation coefficient (ICC) can be computed as

$$ICC = \frac{\tau_{00}}{\tau_{00} + \sigma^2} \,. \qquad (2)$$

The ICC represents the expected correlation between two observations of the same group and it is therefore a measure of the degree of homogeneity among observations in the same group. The correlation coefficient expresses the percentage of the total variance that is accounted for by the school; as a consequence, the more the ICC approaches 1, the stronger are the school effect and the need for a multilevel analysis.

Because the multilevel analyses will include the ESCS and the school type as covariates, students with missing ESCS or still in lower secondary school have been deleted. This caused the loss of only 0.68% of observations, leading to a sample size of 30,695 students. All the multilevel analysis in this section are conducted by using the software HLM (Raudenbush et al., 2008), which is able to handle both sample weights and plausible values in the definition of the response variable.

The results of the estimation of the empty model are presented in Table 6 for Italy, the Italian regions and macro-areas by considering as outcome the reading score. The intercept term is still a measure of efficacy of geographical areas, and again the highest estimates are associated to Northern regions (especially Friuli Venezia Giulia, Lombardia, and Trento) while the lowest estimates are recorded for Calabria, Campania and Sicilia. On the other hand, the ICC can be taken as a measure of equity among schools within the same region. The ICC for Italy is about 0.56 meaning that about the 56% of the variability in the student performance can be explained by school differences. In particular, the less equitable regions are Emilia-Romagna, Lombardia, Marche, Sicilia and Umbria, while the most equitable regions are Abruzzo, Basilicata and Bolzano. Looking at the results in the macro-areas, the North-West seems to be the less equitable area.

Table 6: Parameter estimates of the empty model for the reading score

	γ_{00}	τ_{00}	σ^2	*ICC*
Italy	480.5	5057.8	4034.4	0.56
Abruzzo	477.3	3568.5	3952.9	0.47
Basilicata	466.8	3544.9	3889.5	0.48
Bolzano	490.2	3790.6	4381.5	0.46
Calabria	440.0	4303.6	3836.7	0.53
Campania	445.9	4314.8	4269.5	0.50
Emilia-Romagna	498.8	5548.3	4473.9	0.55
Friuli Venezia Giulia	509.3	4508.4	3912.2	0.54
Lazio	479.6	4141.7	4144.0	0.50
Liguria	485.1	4534.7	4358.0	0.51
Lombardia	511.5	4872.6	3826.6	0.56
Marche	492.6	4898.6	3766.6	0.57
Molise	463.1	3749.2	3736.6	0.50
Piemonte	491.6	4638.9	4186.6	0.53
Puglia	485.6	3926.8	3639.6	0.52
Sardegna	458.9	4410.4	4457.3	0.50
Sicilia	450.2	4743.9	3928.0	0.55
Toscana	490.1	4473.2	4330.8	0.51
Trento	506.3	4575.1	3999.4	0.53
Umbria	485.1	5396.7	4131.4	0.57
Valle d'Aosta	500.0	4074.7	3908.9	0.51
Veneto	502.1	4119.6	3804.9	0.52
North-West	503.2	4890.5	3977.9	0.55
North-East	501.2	4704.7	4095.8	0.53
Centre	484.7	4456.0	4140.4	0.52
South	463.0	4449.5	3998.1	0.53
South-Islands	450.3	4571.3	3981.9	0.53

Note: all intercept estimates are significant at the 1% level.

These results can be deepened by introducing covariates in the model, which are able to reduce both the between and the within variance. Therefore, it will be possible to understand the contribution of the explanatory variables to the decrement in the variability. In particular, we decided to include at the student level the indicator of socio-economic and cultural background (ESCS) and at the school level the school mean ESCS (MU_ESCS) and the school type, recoded into three dummy variables (ACAD for academic, VOC for vocational and VOC_T for vocational training schools) with technical institutes as reference group. The continuous variable ESCS was not centered; in fact, the value "0" is meaningful and corresponds to the mean ESCS in OECD countries. We consider a model with random intercept and fixed slopes. The first level model is

$$Y_{ij} = \beta_{0j} + \beta_1 ESCS_{ij} + \varepsilon_{ij}\,, \tag{3}$$

while the second level model is

$$\beta_{0j} = \gamma_{00} + \gamma_{01} MU\_ESCS + \gamma_{02} ACAD + \gamma_{03} VOC + \gamma_{04} VOC\_T + u_{0j}\,. \tag{4}$$

Substituting equation (4) into equation (3) gives the combined form of the two-level random intercept model with level 1 and level 2 predictors. Analogously to model 1, the between variance is $V(u_{0j})=\tau_{00}$ while the within variance is $V(\varepsilon_{ij})=\sigma^2$. Table 7 shows the model estimated parameters.

Table 7: Parameter estimates of the two-level random intercept model for the reading score

	γ_{00}	β_1	γ_{01}	γ_{02}	γ_{03}	γ_{04}	τ_{00}	σ^2	*ICC*
Italy	486.4***	5.1***	44.0***	34.4***	-42.8***	-55.4***	1912.8	4017.0	0.32
Abruzzo	458.3***	2.7	28.2	61.6***	-30.8*	-99.5**	553.2	3947.7	0.12
Basilicata	494.1***	2.7	76.2***	21.7	-40.0**	-	450.9	3884.6	0.10
Bolzano	516.0***	5.2*	17.2	35.2**	-56.5**	-72.9***	822.3	4369.1	0.16
Calabria	425.8***	4.7*	30.9**	69.7***	-24.1	-	858.4	3824.8	0.18
Campania	425.6***	3.4	20.0	81.3***	-25.2	-	1029.3	4261.2	0.19
Emilia-Romagna	500.2***	10.9***	16.2	55.0***	-63.8***	-118.8***	472.2	4401.2	0.10
Friuli Venezia Giulia	519.3***	5.8*	40.6*	36.8**	-67.3***	-97.3***	609.5	3892.8	0.14
Lazio	458.8***	7.0*	-2.7	64.6***	-57.1**	-107.7***	1180.9	4124.3	0.22
Liguria	487.9***	5.4*	36.6	33.6*	-53.2	-51.4*	1841.7	4340.8	0.30
Lombardia	529.3***	5.9*	41.6	19.6	-44.2*	-111.1***	1094.0	3801.8	0.22
Marche	504.8***	2.4	29.4	36.4*	-76.6***	-	1452.0	3768.5	0.28
Molise	473.7***	7.2**	54.9***	21.7	-36.0*	-	1005.1	3694.9	0.21
Piemonte	517.2***	6.3*	35.6	18.2	-78.0***	-54.9***	1161.7	4166.5	0.22
Puglia	498.5***	3.6*	32.6	38.4*	-48.5*	-	1425.6	3630.5	0.28
Sardegna	452.3***	3.9	22.1*	70.4***	-64.4***	-	358.4	4450.8	0.07
Sicilia	435.3***	6.1*	15.3	68.2**	-40.2*	-	1670.8	3899.8	0.30
Toscana	486.0***	5.6	4.1	61.1***	-83.9***	-	784.6	4310.6	0.15
Trento	525.9***	3.6	65.3***	29.4*	-48.4**	-66.6***	488.2	3989.0	0.11
Umbria	471.4***	7.6**	39.4	52.2**	-45.4*	-58.0*	1553.2	4095.7	0.27
Valle d'Aosta	524.3***	2.7	45.7	36.9	-34.8*	-75.4**	917.1	3904.2	0.19
Veneto	524.1***	1.3	54.5**	9.5	-33.1*	-89.0***	1212.0	3803.6	0.24
North-West	522.7***	5.9**	42.5**	17.6	-54.2***	-89.7***	1438.6	3954.8	0.27
North-East	513.9***	5.4***	41.2***	28.7**	-46.7***	-83.4***	1034.9	4077.7	0.20
Centre	473.7***	6.0**	-3.6	61.6***	-70.8***	-118.9***	1310.7	4123.0	0.24
South	452.0***	3.5**	20.3	66.4***	-35.4**	-95.9**	1565.2	3988.3	0.28
South-Islands	438.5***	5.2**	22.0**	66.7***	-40.1***	-	1310.7	3964.7	0.25

Note: *** significant at the 1% level, ** significant at the 5% level, * significant at the 10% level.

For this model, the intercept represents the estimated score for a reference student, i.e. with ESCS equal to zero, within a school with ESCS mean equal to zero, and belonging to a technical institute. The reading score for this target student is higher than 500 in all the Northern regions, with the only exception of Liguria, whereas it is particularly low in Calabria, Campania and Sicilia. The net effect of ESCS (β_1) on the reading performance is largely significant for Italy, Emilia-Romagna and North-East, and it is significant at the 5% level for the other macro-areas. The effect of the school ESCS mean (γ_{01}) is significant at the 1% level for Italy, several regions, and North-East. Looking at the school type, the impact of being a student in an academic track instead of a technical one (γ_{02}) means an increase of about 34 score points in Italy, and more than 60 points in the Centre and Southern regions. On the other hand, the fact of being a student in a vocational school instead of in a technical one (γ_{03}), means about 43 points less on average, that become about 55 when observing a student in a vocational training track (γ_{04}).

Taking into account socio-economic background and the school type leads to a reduction of the between variance of about 62% while the reduction of the residual variance is only 4% for the whole country.

Finally, a last attempt of exploring the different sources of variability in the student performance has been done considering an empty three-level model. In particular, the three-level units have been identified both in the regions and in the macro-areas. The combined three-level model, without covariates follows this formulation:

$$Y_{ijk} = \gamma_{000} + u_{00k} + u_{0jk} + \varepsilon_{ijk}, \tag{4}$$

where $k=1,...,K$ are the three-level units (regions or macro-areas), Y_{ijk} is the score on the reading scale of the i-th student belonging to school j-th in the k-th region or macro-area, $V(u_{00k})=\tau_k$ is the between region (or macro-area) variance, $V(u_{0jk})=\tau_{jk}$ is the variance of schools in the same region (or macro-area) and $V(\varepsilon_{ijk})=\sigma^2$ is the residual (or within) variance. The intraclass correlation can be calculated both at a school and region (or macro-area) level by dividing the corresponding variance to the total variance. Results are presented in Table 8.

Table 8: Parameter estimates of the three-level empty model for the reading score

	γ_{000}	τ_k	τ_{jk}	σ^2	ICC_k	ICC_{jk}
Regions	481.9	334.78	4,488.6	4,045.1	0.04	0.51
Macro-areas	479.5	420.7	4,634.2	4,039.1	0.05	0.51

Note: intercept are all significant at the 1% level.

As can be easily seen, the percentage of variability attributed to regions is only the 4%, while the 51% of variability is due to the difference between schools in the same region. Analogous results are obtained when using the macro-areas as three-level units.

5 Concluding remarks

The analyses conducted on data from OECD PISA last edition (2009) showed wide differences in student performances between Italian macro-areas and regions. In particular, students in the North and particularly in the North-West outperformed their colleagues in the Centre and especially in the Southern part of the country. By using a multilevel analysis, it was shown that regions are not different only in effectiveness but also in equity. In fact, much variability in the results can be explained by the between school variance, which is rather high for several regions. Also, by estimating an empty three-level model, it was shown that much of the variability depends on differences between schools within the same region or macro-area. Analogous results are obtained when analysing mathematical and scientific literacy instead of reading. This result highlights that differences between schools overcome territorial difference. Even if school gaps are widely known by researchers and institutions, the causes should be investigated more in detail, especially in order to suggest ways of improvement.

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Non-Compensatory Aggregation of Social Indicators: An Icon Representation

Matteo Mazziotta and Adriano Pareto

Abstract In this paper, we consider a non-compensatory composite index, denoted as MPI (Mazziotta-Pareto Index) and propose an original method for visualizing the index value for a set of statistical units. The MPI is characterized by two elements: ‘mean’ and ‘penalty’. The idea is to represent each unit as a particular graphical object, a ‘stickman with a sack’, where the value of the ‘mean’ is assigned to the dimension of the ‘stickman’ and the value of the ‘penalty’ is assigned to the dimension of the ‘sack’. The assignment is such that the overall appearance of the object changes as a function of the MPI values.

Key words: composite index, data visualization

1 Introduction

Composite indices for comparing country performance with respect to multi-dimensional phenomena, such as development, poverty, quality of life, etc., are increasingly recognized as a useful tool in policy and public communication (OECD, 2008).

Considerable attention has been devoted in recent years to the fundamental issue of compensability among the components of the index (a deficit in one dimension can be compensated by a surplus in another) and more and more often a non-compensatory approach has been adopted (e.g. the ‘new’ Human Development Index calculated by UNDP in 2010 is given by a geometric mean).

The aim of this work is to provide an original graphical method, called “Traveller Icon” plot, for representing the non-compensatory aggregation of individual indicators by MPI (De Muro *et al.*, 2010).

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The proposed method allows not only visualizing and analyzing the message contained in data, but also remembering it, since for most of people, visual memory is more persistent than verbal or auditory memory (Zinovyev, 2011). For that reason, it can serve as a powerful propagandistic or educational tool.

In Section 2, a brief description of MPI is reported; in Section 3, the “Traveller Icon” plots are presented; finally, in Section 4, an application to real data is proposed.

2 A non-compensatory composite index

The MPI (Mazziotta-Pareto Index) is a composite index based on the assumption of ‘non-substitutability’ of the indicators, i.e., they have all the same importance and a compensation among them is not allowed (De Muro *et al.*, 2010).

Given the matrix $\mathbf{X}=\{x_{ij}\}$ with n rows (units) and m columns (indicators), we calculate the standardized matrix $\mathbf{Z}=\{z_{ij}\}$ where the j-th indicator is converted to a common scale with a mean of 100 and a standard deviation of 10.

Denoting with M_i, S_i, cv_i, respectively, the mean, the standard deviation and the coefficient of variation of z_{ij} $\{j=1, \ldots, m\}$, the generalized form of MPI for the i-th unit is given by:

$$\mathrm{MPI}_i^{+/-} = \mathrm{M}_i \pm \mathrm{S}_i \mathrm{cv}_i$$

where the sign ± depends on the kind of phenomenon to be measured.

This approach is characterized by the use of a function (the product $\mathrm{S}_i\,\mathrm{cv}_i$) to penalize the units with ‘unbalanced’ values of the indicators. The ‘penalty’ is based on the coefficient of variation and is zero if all the values are equal. The purpose is to favour the units that, mean being equal, have a greater balance among the different indicators.

Therefore, the MPI is characterized by the combination of a ‘mean effect’ (M_i) and a ‘penalty effect’ ($\mathrm{S}_i\,\mathrm{cv}_i$).

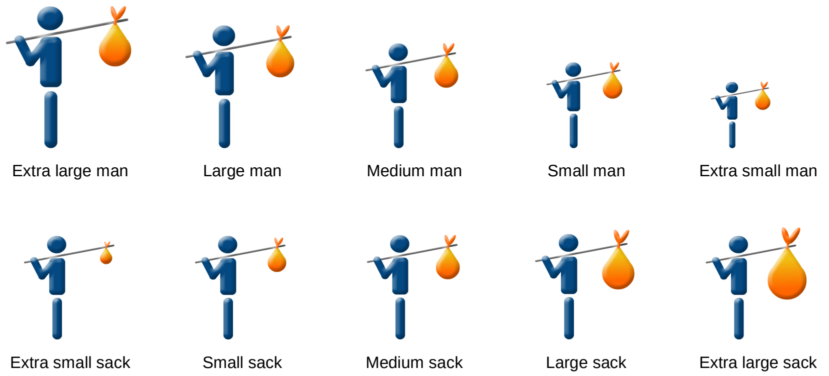
3 The “Traveller Icon” plots

The basic idea of “Traveller Icon” plots is to represent each unit as a ‘stickman with a sack’, where the value of the ‘mean’ of the standardized indicators is assigned to the dimension of the ‘stickman’ and the value of the ‘penalty’ is assigned to the dimension of the ‘sack’. In this way, the overall appearance of the icon changes as a function of the MPI values.

Figure 1 shows some examples of “Traveller Icon” for decreasing values of the ‘mean’ (‘stickman’ dimension) and increasing values of the ‘penalty’ (‘sack’ dimension). All the combinations of ‘sacks’ and ‘stickmen’ are possible.

Examining such icons may help to discover interactions between ‘mean effect’ and ‘penalty effect’ and identify specific clusters of units (e.g. units with high values of ‘penalty’ are represented by ‘stickmen with a large sack’, whereas units with low values are represented by ‘stickmen with a small sack’).

Figure 1: Examples of “Traveller Icon”



4 An example of application

In order to show the graphical representation of the MPI by “Traveller Icon” plots, an application is presented where ten indicators of quality of life in the Italian cities, at regional level, are selected (Sporting activities, Distance to supermarkets, Air quality, Urban crime, Green space, Public transport, Parking provision, Attractiveness of universities, Attractiveness of health services, Children’s services)[1]. The MPI^- is used, since the composite index is ‘positive’, i.e., increasing values of the index correspond to positive variations of the phenomenon.

Table 1 reports the ranking of the regions by MPI^-. Also provided in the table are the mean of the standardized values of indicators and the penalty.

Table 1: Italian regions ranking by MPI^-

Region	Mean	Penalty	MPI	Rank	Region	Mean	Penalty	MPI	Rank
Piemonte	98.74	0.43	98.30	13	Marche	102.05	0.15	101.90	7
Valle d'Aosta	104.07	4.23	99.84	11	Lazio	97.88	0.82	97.06	14
Lombardia	101.38	0.64	100.74	10	Abruzzo	102.90	1.30	101.60	8
Trentino-A. Adige	106.10	0.63	105.47	1	Molise	91.43	1.02	90.42	20
Veneto	104.38	0.77	103.61	3	Campania	94.12	0.37	93.75	17
Friuli-Venezia G.	105.55	0.34	105.21	2	Puglia	96.78	0.21	96.58	15
Liguria	102.76	0.29	102.47	6	Basilicata	93.55	2.37	91.18	19
Emilia-Romagna	103.62	0.46	103.16	5	Calabria	92.59	0.51	92.08	18
Toscana	101.84	0.27	101.57	9	Sicilia	96.29	0.31	95.98	16
Umbria	103.52	0.22	103.30	4	Sardegna	100.45	0.76	99.69	12

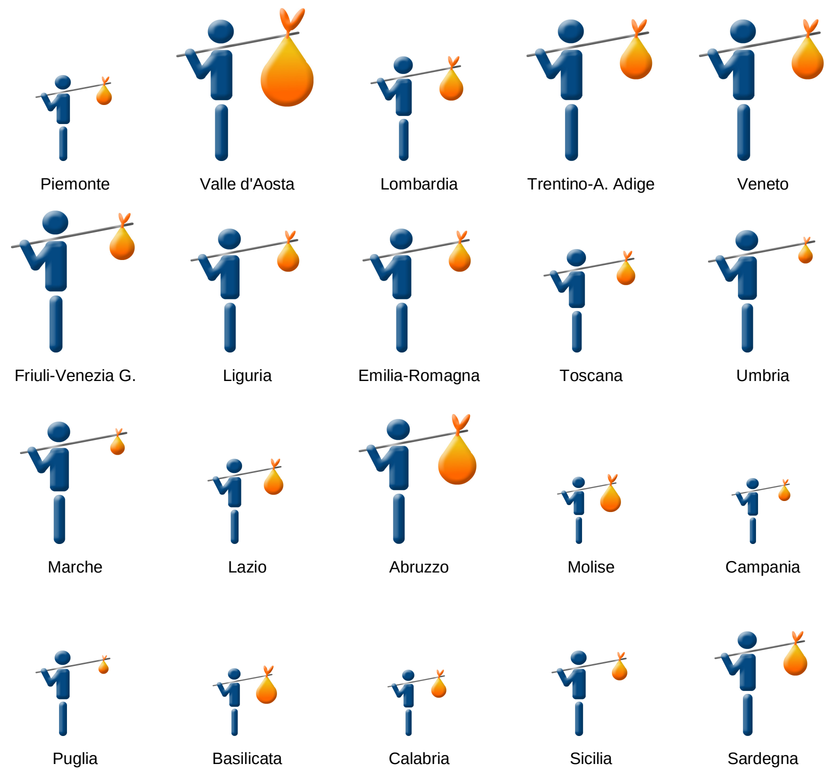
The traveller plots are displayed in Figure 2, where five dimensional classes for the ‘stickman’ (Mean<95; 95-100; 100-102; 102-104; >104) and the ‘sack’ (Penalty<0.25; 0.25-0.5; 0.5-1; 1-2.5; >2.5) were fixed.[2] Obviously, the higher the number of classes, the greater the accuracy of the icons.

[1] http://www.istat.it/ambiente/contesto/infoterr/assi/asseV.xls

[2] The classes are defined on the basis of the distributions of values across regions.

Note that Valle d'Aosta (rank 11) has a high value of the mean (extra large man), but a high value of the penalty (extra large sack) too; indeed its ranking is much lower compared to Veneto (rank 3). Umbria and Marche are rather similar regions in terms of both mean and penalty. Finally, Molise (rank 20) and Basilicata (rank 19) have low values of the mean (extra small man) and high values of penalty (large sack).

Figure 2: Traveller plots of the Italian regions by MPI$^-$



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Measuring Social Inequality in Europe from a Multidimensional Point of View

M. Mazziotta, A. Pareto, V. Talucci

Abstract: The distribution of income has always played a central role in measuring social inequality. In fact, according to Pareto, only one-dimension of this phenomenon has been considered. The aim of this paper is to define and to measure a complex phenomenon like social inequality, both from a theoretical point of view and from a statistical point of view. The approach is interdisciplinary, taking into consideration: a) the socio-economic theory, in order to find precursory concepts from the classical studies; b) methodological aspects, in order to define a precise model of empirical research; c) statistical measures in order to synthesize the phenomenon. The domain is the Europe of 27 member countries. It is a secondary analysis of data in which the source is Eurostat database, containing the set of standardized and harmonized indicators regarding the study of the "Social and Living Condition" at European level. As the main objective is to compare different models of aggregation (innovative vs. classical composite indicators), verifying the consistency of results and the validity of the chosen indicators, there is a special emphasis on the strategies of these indicators' synthesis. Besides that, the paper aims at not only providing some keys of interpretation of the phenomenon, but also at finding some statistical tools as consistent as possible with the measurement of the social inequality.

1 Socio-Economic Theory

The approach is interdisciplinary. Regarding the theories, we have considered some classic and modern concepts on the study of the poverty and social exclusion. Besides that, we have taken into account the phenomenon from an economic perspective as well as that has been integrated with social aspects of family networks, employment, health

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and welfare. The problem is to redistribute fairly a lot of 'things': income, resources, environment, education, social welfare services, health conditions etc. The most important issue is the identification of portions of population living in no fairly conditions with regard to the mentioned 'things'.

Recalling the Rawls Theory of Justice (Rawls, 2005), the importance of putting people in a position to overcome the conditions of poverty has been considered, giving them empowerment; it is necessary, therefore, that they enable to overcome situations of distress (ill-being). This theory is based on some principles, listed as follows. The principle of basic liberty, which refers to the inviolability of the rights of citizenship (it is a fundamental freedom for each individual); the principle of the use of the primary goods such as income, wealth, power, social position, self-respect, freedom and opportunities. These primary goods are determined by flows and, in their turn, they are factors determining different situations to be and to have between individuals. This redistributive mechanism exists through the difference principle (principle of compensation) whereby the distribution of primary goods has to be delivered in order to favourite the disadvantage persons. In fact, the greatest amount of good primary must be ensured to poorer; in this way, the guarantee of basic liberty is given by the difference principle.

This work is based on the material deprivations theory related to primary goods (Theory of Justice - Rawls) and Theory equality of basic capabilities – Sen (Sen, 1992). The actions of welfare must intervene on vulnerable and deprived portions of the population, with high risk of exclusion in order to plan actions or re-distributional income plans, whereby each individual must be enabled to realize fully their ambitions (Theory the right - Dworkin).

2 Methods for composite index building

The overall objective of this paper is both to individuate a set of indicators representing social inequality (in a multidimensional point of view), and to apply some composite indicators in order to implement ranking and to design a European geographic inequality. The results obtained by the measured phenomenon, through different methodologies, aims to understand the effectiveness of the chosen indicators and then the consistency with the asserted theory. The innovative contribution presented in this paper is both the selection of the variables like proxies of the social inequality and the choice of the composite indicators better representing the phenomenon.

The geographical domain is the Europe of the 27 member countries: it is a 'secondary analysis' of data of Eurostat database "Social and Living Condition". The matrix is composed by 6 indicators having the property of 'non-substitutability', i.e., they have all the same weight (importance) and a compensation among them is not allowed (Munda and Nardo, 2005).

The method proposed by the authors provides a synthetic measure of a set of 'non-substitutable' indicators. The alternative composite index, called MPI - Mazziotta-Pareto Index - (Mazziotta and Pareto, 2010), starts from a linear aggregation and introduces penalties for the European Countries with 'unbalanced' values of the indicators.

Figure 1: List of Indicators

SUBJECT	INDICATOR	DEFINITION
Social Inclusion	At risk of poverty rate	Share of persons with an equivalised disposable income below 60% of the national equivalised median income
Income	Gini coefficient	Summary measure of the cumulative share of equivalised income accounted for by the cumulative percentages of the number of individuals
Education and Training	Early school leavers	Share of persons aged 18 to 24 who have only lower secondary education and have not received education or training in the four weeks preceding the survey
Labour Market	Long term unemployment rate	Totale long term unemployment population (12 months; ILO definition) as a proportion of total active population aged 15 years or more
Social Protection	Projected Total Public Social expenditures	Projections of total public social expenditures in health care, current level (% of GDP) and projected change in share of GDP (in percentage points)
Health Care	Self reported unmet need for medical care	Total self-reported unmet need for medical care in terms of number of people who reported that at least once in the previous 12 months they felt they needed medical care and did not receive it either because they had to wait, or it was too expensive, or it was too far away

The steps to compute the MPI are the following: a) ‘standardization’ of the individual indicators in a scale with a mean of 100 and a standard deviation of 10; b) aggregation of the standardized indicators by arithmetic mean with penalty function based on the ‘horizontal variability’ (standardized values variability for each unit).

The generalized form of MPI is given by:

$$\mathrm{MPI}_i^{+/-} = \mathrm{M}_i \pm \mathrm{S}_i \mathrm{cv}_i$$

where M_i, S_i, cv_i, are respectively the mean, the standard deviation and the coefficient of variation of the standardized values. The sign ± depends on the kind of phenomenon to be measured (for social inequality, the MPI_i^{+} is used).

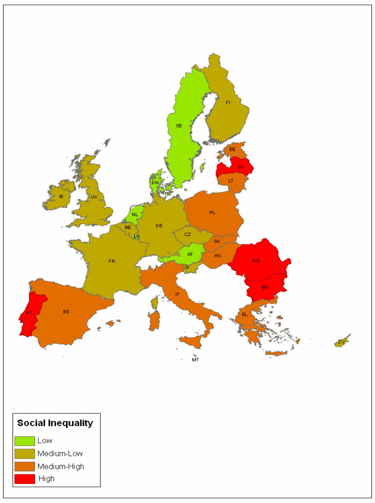
The MPI is a non-compensatory alternative index that wants, in the scientific outline, both to respect the desirable characteristics of a composite index and to be validly applied to different scientific contexts. In fact, this methodology is not conditioned by the ‘polarity’ and by the ‘range’ of the individual indicators. Therefore, the MPI can be a useful ‘tool’ to synthesize multidimensional phenomena (positive like development and negative like social inequality).

The combination of the 6 individual indicators by the MPI represents a new tool called SINCI (Social Inequality Composite index).

3 Main results

From the socio-economic point of view, the results of the application, even if there are some clear differences due to the methodologies, have designed a consistent geography of social inequality in relation to the multidimensional theoretical framework. At least we have analyse the weight of the indicators on the synthetic function and their explanatory and predictive power. To meet this need-finding, it was decided to apply a multiple regression with stepwise method.

Figure 2: The map and the level of social inequality[1]



COUNTRY	MPI	GROUP	LEVEL OF SOCIAL INEQUALITY
Denmark	89,90	1	
Sweden	90,97	1	
Austria	91,09	1	LOW
Netherlands	91,44	1	
Luxembourg	93,35	1	
Slovenia	93,73	2	
Finland	94,24	2	
Czech Republic	94,50	2	
France	96,28	2	
Germany	96,69	2	MEDIUM-LOW
Belgium	97,52	2	
Ireland	98,90	2	
Cyprus	98,95	2	
United Kingdom	99,52	2	
Hungary	102,14	3	
Spain	102,29	3	
Malta	102,62	3	
Estonia	104,43	3	
Italy	104,59	3	MEDIUM-HIGH
Lithuania	105,39	3	
Slovakia	105,40	3	
Greece	106,58	3	
Poland	107,48	3	
Bulgaria	109,95	4	
Portugal	109,98	4	HIGH
Latvia	112,59	4	
Romania	114,19	4	

The weight on the dependent variable is due to its subjective indicator expressing the level of dissatisfaction reported by public attitudes about health services offered by the state (β=0.810), in the second model, the weight is borne on the dependent variable indicator dissatisfaction (β=0.594) and the Gini coefficient (β=0.477) in the third the three different inputs are the indicator of dissatisfaction (β=0.539), Gini coefficient (β= 0.471) and unemployment (β= 0.296) and so up to the model 6. It would seem that the subjective dimension weights more than the objective dimension related to income. This results goes to the direction of some international studies and plans (e.g., Stiglitz Commission) in considering more sociological dimensions of perception to understand, more deeply, the situations of deprivation in the geographical area. The second result has an important statistic value: when all six indicators enter in the model, the beta values are essentially the same amount, which means that, when considered together with all the indicators have, on SINCI, each about the same effect.

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[1] The classes were derived by grouping countries according to their standard deviation value calculated on the scores of SINCI. This method of classification is based on the intensity of the distance that each country has with the mean value of social inequality.

Le rivoluzioni incomplete delle donne italiane

Letizia Mencarini

Abstract

Dall'Unità di Italia ad oggi la partecipazione alla vita sociale ed economica delle donne italiane è cambiata moltissimo, di pari passo con cambiamenti epocali dei comportamenti demografici che le vedono avere meno figli, sposarsi più tardi e avere una vita lunghissima (se comparata a quella delle donne di un secolo e mezzo fa). L'Italia è stata però spesso – nel corso nel '900 – tra le ultime nazioni più avanzate a raggiungere determinate conquiste in tema di parità uomo-donna, ma soprattutto ancora oggi è in pesante ritardo rispetto a paesi con eguale sviluppo economico, e anche a paesi peggiori di noi in termini economici, nel coinvolgimento delle donne nella società e nel mercato del lavoro. La situazione di quasi stallo degli ultimi decenni vede di conseguenza l'Italia intrappolata in una situazione di bassa fecondità, diseguaglianza di genere e inefficienza socio-economica, lontana dal completamento di quella "rivoluzione" socio-demografica scatenata nei paesi a sviluppo avanzato dal coinvolgimento delle donne nell'istruzione superiore. Solo questa prima rivoluzione, della piena partecipazione femminile all'istruzione, è stata infatti completata.

1 Pari opportunità, eguaglianza ed equità di genere

Il concetto di genere nelle scienze sociali si riferisce all'identità personale di uomini e donne in rapporto alla rappresentazione sociale e al sesso biologico, da cui spesso prescinde. Da una parte ci si può riferire al genere in termini di pari opportunità, cioè all'eguaglianza (anche legislativa) di possibilità e di diritti garantiti ad uomini e donne (e quindi, a contrario, all'esistenza o meno di discriminazioni secondo il genere), dall'altra in termini di eguaglianza di genere, riferendoci alla parità reale nella partecipazione alla vita sociale ed economica di uomini e donne. Infine, possiamo parlare di equità. Se, infatti, l'uguaglianza di genere non può esistere per definizione (uomini e donne sono biologicamente diversi), nel sistema di genere di una società –

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cioè l'insieme delle norme sociali prescrivono una certa divisione del lavoro e delle responsabilità tra donne e uomini, garantendo differenti diritti e obblighi per essi (Mason 2001) – è molto importante ciò che è percepito come equo e "normale" nel comportamento e nei compiti per genere. Così ad esempio non è la disuguaglianza reale fra uomini e donne a causare senso di insoddisfazione o di iniquità, ma la distanza dal comportamento medio (McDonald 2010): non sono insoddisfatte e infelici tutte le donne che hanno carichi di lavoro e familiari elevati rispetto a quelli dei loro partner, ma coloro che sperimentano una condizione di disuguaglianza molto diversa dalla situazione media della propria società, e quindi la percepiscono come iniqua (Mencarini e Sironi 2010). Del resto il confine tra differenza e disuguaglianza o discriminazione è talvolta difficile a stabilirsi. L'assenza di differenza, o il ridursi delle differenze, può mascherare una disuguaglianza o persino esserne una parziale componente: l'uguaglianza non è che apparente quando le donne partecipano alla vita attiva nella medesima proporzione degli uomini, ma rimangono le uniche a farsi carico della vita domestica, conducendo così una faticosa "doppia presenza" nel lavoro retribuito, in quello domestico e nella cura dei figli. E d'altra parte neanche tutte le differenze sono discriminatorie. A volte differenze di trattamento, ad esempio a favore di una madre lavoratrice, possono essere considerate eque.

Lo scopo di questo lavoro, alla luce di queste distinzioni teoriche, è quello di delineare il cammino storico recente e la situazione della condizione femminile in Italia, con particolare riguardo alla formazione del capitale umano, all'attività lavorativa dentro e fuori la famiglia e ai legami che i mutamenti di questi comportamenti hanno implicato sul comportamento riproduttivo. Per comprendere il cammino, e anche l'attuale situazione, le donne italiane non vengono solo confrontate con gli uomini italiani, ma con le donne di altri paesi europei: tre paesi vicini, Francia, Spagna e Germania, e due più lontani, Gran Bretagna e Svezia.

Attualmente, nel panorama dei paesi dell'Unione Europea, e più in generale dei paesi sviluppati, l'Italia si distingue per essere sempre in fondo alle classifiche stilate in base ad indicatori che riguardano la famiglia e la fecondità, il sistema di genere dentro e fuori la famiglia, il lavoro femminile, gli investimenti pubblici per le famiglie e i bambini. Il quadro che ne emerge è quello di una società statica, impigliata – si direbbe – in una trappola di bassa fecondità e bassa partecipazione lavorativa femminile, dalla quale la maggior parte dei paesi dell'Europa centro-settentrionale sono usciti con il coraggio di investimenti pubblici che ora producono ricadute positive sia sugli individui che sui sistemi economici. Gli studiosi si affannano a ricercare radici storiche delle "peculiarità" italiane, dove il "familismo" prevalente non impernia solo i rapporti umani, ma soprattutto il rapporto degli individui e delle famiglie con lo Stato, che continua a demandare alla Famiglia, onnipotente e onnipresente, i compiti di cura di bambini e anziani e la funzione di principale ammortizzatore sociale. Senza entrare nel dibattito dell' "uovo e la gallina" – cioè se in Italia vi sia poca offerta di taluni servizi perché la domanda non è sostenuta, o viceversa – bastano pochi numeri per delineare un quadro poco eclatante, dove non ci si deve sforzare per vedere nella popolazione di sesso femminile, e nelle nuove generazioni, le categorie più bisognose di interventi per attenuare discriminazioni di genere e generazionali (Mencarini 2010).

La tesi di fondo è che, sebbene le donne italiane non siano partite avvantaggiate nella rincorsa dell'uguaglianza di genere rispetto agli altri paesi europei, e anzi, nel corso del '900, non siano state certo tra le prime a raggiungere determinate conquiste in tema di parità uomo-donna, l'attuale situazione non è storicamente giustificabile con la categoria del ritardo del Sud Europa rispetto ad altri paesi. Le differenze sono forti, anche rispetto a paesi con eguale sviluppo economico, e anche a paesi peggiori di noi in termini economici, nella partecipazione alla vita politica ed economica del paese da parte delle donne, con un'accentuata segregazione di funzioni e posizioni. L'attuale situazione delle donne italiane, fanalino di coda tra tutte le Europee per bassa partecipazione lavorativa, elevati carichi familiari e bassa fecondità, può essere interpretata non più solo come ritardo o come retaggio di una mentalità dell'Europa meridionale di tipo familistico, ma anche come frutto di una recente situazione di stallo, che differenzia l'Italia anche da paesi culturalmente molto simili, ad esempio la Spagna.

2 Una rincorsa che parte da lontano, tra eguaglianza dei diritti e permanenza della disuguaglianza

La rincorsa delle donne italiane verso la parità di genere ha raggiunto, se adottiamo una prospettiva storica che parta ad esempio dall'Unità di Italia, importanti conquiste in termini legislativi e di pari opportunità. Tra le conquiste epocali nella legislazione delle pari opportunità si possono citare l'ammissione al pubblico impiego nel 1919, il diritto di voto nel 1946, la parità salariale e l'eliminazione delle clausole di nubilato nel 1963, il divorzio nel 1970, la tutela della maternità delle lavoratrici nel 1971, la riforma del diritto di famiglia del 1975 che introduce la parità giuridica dei coniugi e di entrambi i genitori, la cosiddetta "legge di parità" nel mercato del lavoro del 1977, l'aborto nel 1978, nel 1999 l'ammissione a far parte delle forze armate.

Nella tabella 1 si confrontano le date al diritto di voto alle donne e delle leggi sull'aborto e sul divorzio nei sei paesi europei scelti: come si vede l'Italia non è certo un paese precursore, ma in nessuna di queste "tappe" arriva per ultima.

Per quanto riguarda la partecipazione politica, la prima donna in un'elevata carica dello stato è arrivata nel 1979[1], ma l'Italia a differenza di Gran Bretagna e Germania (ma insieme a Francia, Spagna e anche Svezia) non ha mai avuto una donna primo ministro o capo dello stato. Le donne italiane nel primo parlamento repubblicano del 1946 furono 21 su 556, cioè meno del 4%, ma come si vede nella figura 2, ancora agli inizi degli anni '80, a parte l'eccezione scandinava, anche negli altri paesi la situazione della rappresentanza femminile era su questi livelli. Anzi, in Spagna, Francia e Regno Unito le donne parlamentari di 30 anni fa erano sensibilmente meno che in Italia. Successivamente, a partire dagli anni '90, in Spagna e Germania, la progressione è molto rapida, pur senza raggiungere i livelli superiori al 45% della Svezia. In Italia, Francia e Regno Unito, pur aumentando, le presenza femminili in parlamento rimangono intorno ad un quinto del totale degli eletti.

È proprio la partecipazione alla vita sociale e politica (la presenza-assenza nel mercato del lavoro e in parlamento) che inseriti come indicatori in indici compositi sulla condizione femminile spingono l'Italia sempre in fondo alle classifiche, tra l'altro con una progressiva perdita di posizioni proprio negli ultimi anni. Ad esempio secondo l'indice di gap di genere l'Italia è in 74esima posizione (WEF 2010), seguita in Europa solo da Malta e la Romania; secondo l'indice GEM ("Gender Empowerment Index", UNDP, 2009) l'Italia è 21esima, ultima rispetto agli altri paesi europei. Ci sono, infatti, paesi europei dove lo sviluppo – inteso nella sua accezione basilare e misurato dall'indice di sviluppo umano – è minore di quello dell'Italia, ma nei quali la partecipazione al "potere" economico e politico da parte delle donne è ben più alta di

[1] Nilde Iotti divenne Presidente della Camera.

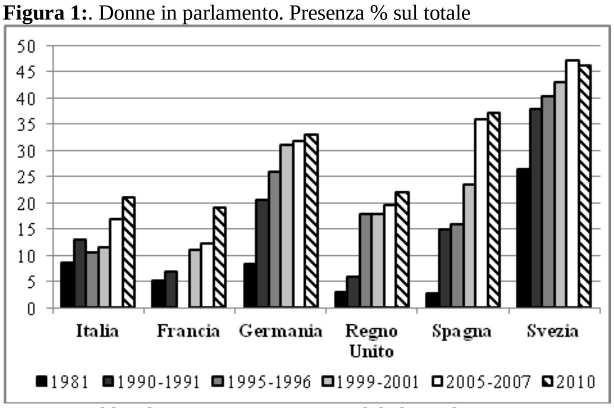
quella delle italiane (e non solo nella già menzionata Spagna, ma anche in Grecia, Portogallo, Repubblica Ceca, Polonia, Estonia, Lituania, Slovacchia, Croazia e Bulgaria). Similmente, l'Italia è al diciannovesimo posto, ultima o quasi dei paesi europei secondo una classifica sullo "stato delle madri", basato su un indicatore riassuntivo delle condizioni di salute, lavoro e pari opportunità delle madri (Save the Children, 2009). Le cose vanno meglio nelle classifiche stilate secondo indicatori che tengono conto della salute, la lunghezza della vita delle donne e il benessere materno-infantile, nelle quali infatti l'Italia risale di diverse posizioni, fino ad arrivare alla nona per il Gender Inequality Index (UNDP, 2011).

Tabella 1: Alcune date e alcuni dati importanti

	Italia	*Francia*	*Germania**	*Regno Unito*	*Spagna*	*Svezia*
Diritto di voto	1945	1931	1918	1946	1919	1928
Aborto	1978	1985	1933	1975	1975	1968
Divorzio	1970	1981	Pre-1950	Pre-1950	Pre-1950	1857**

** Repubblica Democratica Tedesca; ** Esteso nel 1937*
Fonte: Global Gender Gap Report 2010

Figura 1:. Donne in parlamento. Presenza % sul totale



Fonte: World Value Survey 1981-2008, Global Gender Gap Report 2010.

3 Rivoluzioni e stagnazioni

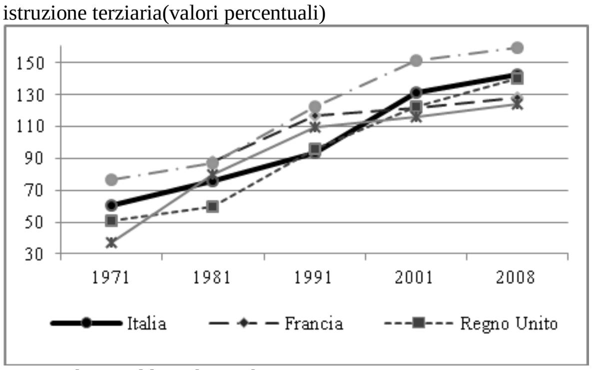
Oggi le donne italiane beneficiano di un contesto di elevato sviluppo e di elevato standard di vita, vivono in uno dei 20 paesi più ricchi e più sviluppati del mondo e rispetto alla salute, all'istruzione, alla sopravvivenza sperimentano condizioni di vita uguali, se non migliori, rispetto a quelle degli uomini. Ma soprattutto – per dirla con Sen (1986), premio Nobel per l'economia e con Nussbaum (2001), la filosofa che ha applicato questi concetti alla condizione di genere – le donne hanno ormai le stesse "*capabilities*" degli uomini, cioè lo stesso livello di capitale umano. Poi, però, le donne italiane non utilizzano a pieno queste potenzialità e sperimentano una scarsissima partecipazione alla vita politica ed economica del proprio paese e, quando vi partecipano, con una accentuata segregazione di funzioni e posizioni.

Il cammino di quella “quiet revolution” (Goldin 2006) che ha trasformato la vita delle donne nella maggior parte dei paesi più sviluppati attraverso cambiamenti, rivoluzionari appunto, nell’istruzione, nel mondo del lavoro e nella famiglia, non è ancora completo per le donne italiane. Il confronto dei dati che le riguardano, sia rispetto agli uomini italiani, che rispetto alle donne degli altri paesi europei, mettono in luce come la prima rivoluzione, quella dell’istruzione femminile, si sia pienamente compiuta, mentre la seconda, quella del mercato del lavoro, resti largamente incompiuta, lasciando le donne intrappolate in una partecipazione lavorativa bassa e segregata. Ma è soprattutto l’ultima delle rivoluzioni, quella nella famiglia, nella ripartizione dei tempi e dei compiti familiari tra uomini e donne, ad essere lontana dal compiersi. I dati più recenti mettono in evidenza come la situazione italiana sia in stallo negli ultimi decenni.

3.1 La rivoluzione compiuta: l’istruzione

Se consideriamo la partecipazione scolastica come un indicatore di uguaglianza formale, possiamo quindi dire che essa sia stata pienamente raggiunta dalle donne italiane. Dall’Unità d’Italia all’inizio del 1900 le lauree conferite a donne furono meno di 300 e meno di tremila quelle degli anni ’30 del 1900 (dati CISUI, Centro Interuniversitario per la Storia delle Università Italiane), ma successivamente le donne italiane, così come quelle della maggior parte dei paesi sviluppati, passano dallo svantaggio al vantaggio. Il sorpasso (come si vede nella figura 2) si compie in Italia negli anni ’90, con tempi simili a quelli del Regno Unito, mentre in Francia, Spagna e Svezia si era già compiuto nel decennio precedente. Anche in Italia, ormai, le donne laureate sono la maggioranza nella fascia di età adulta sotto i 65 anni. Solo oltre i 65 anni – con un chiaro effetto per generazioni – sono in numero inferiore agli uomini. Tra i giovani sono molto superiori (del 74% tra i 20-24 enni, del 56% tra i 25-29 enni e del 51% tra i 30-34 enni). Tra le giovani tra i 20 e i 34 anni dal 1971 al 2009 la proporzione di giovani donne laureate (tra i 20 e i 34 anni) è passata dal 2% al 20% contro un aumento dal 3% al 13% degli uomini (Del Boca e Giraldo 2011). Non solo tra gli immatricolati all’università la maggior parte sono donne, ma sono loro che vanno meglio agli esami, si laureano prima e con un punteggio mediamente più alto rispetto agli uomini (dati Almalaurea). Le differenze di genere non mancano, e in realtà la modernizzazione appare un po’ zoppa se si va a vedere meglio: resta, infatti, una forte autosegregazione formativa femminile verso le facoltà umanistiche, fortemente penalizzate nel mercato del lavoro. Tuttavia le diversità di scelte di studio per genere non bastano a spiegare né i differenziali occupazionali né quelli salariali tra uomini e donne, quest’ultime già penalizzate all’inizio della carriera, anche a parità di formazione e tipologia contrattuale (Del Boca 2007).

Figura 2: Rapporto tra la presenza maschile e femminile nella partecipazione al livello di istruzione terziaria(valori percentuali)



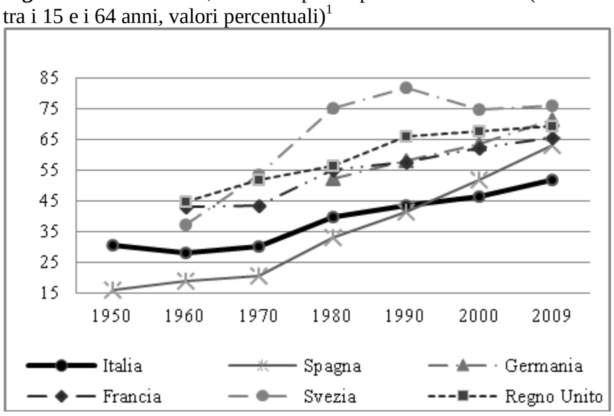
Fonte: The World Bank Database

3.2 *La rivoluzione incompiuta: il lavoro femminile*

Agli ormai altissimi tassi di istruzione delle donne italiane non corrisponde né un tasso di occupazione femminile elevato, né una posizione elevata o egualitaria per genere delle donne nel mercato del lavoro. Le donne italiane sono pertanto una risorsa – in capitale umano – del tutto sottoutilizzata. L'occupazione femminile italiana è la più bassa d'Europa: sono occupate il 48% delle donne in età lavorativa (OECD, 2011), un valore ben lontano dall'obiettivo di Lisbona del 60% di occupazione femminile. Il peso delle donne sul totale degli occupati è passato dal 30% degli anni' 60 al solo 40% attuale. La situazione italiana appare peculiare solo se confrontata con la partecipazione lavorativa delle donne negli altri paesi europei, ma soprattutto guardando ai miglioramenti nell'ultimo decennio. In Italia la crescita dell'occupazione femminile dal 2000 al 2009 è stata inferiore al 7%, contro oltre l'8% della Germania e quasi il 12% della Spagna. Se anche nel nostro paese sono avvenuti notevoli cambiamenti nell'occupazione femminile negli anni '70, in seguito le variazioni sono piuttosto limitate. Emblematico il caso delle donne spagnole che all'inizio degli anni '70 avevano tassi di partecipazione lavorativa molto più bassi di quelli italiani e che attualmente li superano invece di almeno 10 punti percentuali (si veda la figura 3). La scarsa crescita nella partecipazione al mercato del lavoro delle donne italiane dipende soprattutto da quelle con bassi livelli di istruzione. Infatti, l'occupazione è aumentata per le donne con livelli di istruzione più alti, ma è rimasta bassa per le donne meno istruite (Del Boca e Giraldo 2011) e se negli anni '70 non vi erano marcate differenze tra tassi di occupazione di donne diplomate o con la licenza media, attualmente il tasso di occupazione è decisamente più alto tra le donne più istruite. Rispetto agli altri paesi l'Italia è il paese europeo con il più basso tasso di occupazione per le donne con istruzione primaria, che lasciano più facilmente il lavoro dopo la nascita dei figli.

In particolare, infatti, la situazione delle madri italiane appare ancora più lontana da quella delle altre madri europee. L'ostacolo più forte al lavoro femminile rimane in Italia l'impegno familiare, principalmente quello legato alla nascita dei figli. Questa situazione è evidente analizzando i tassi di attività delle donne per età: tra i 25 e i 54 anni il 36% delle donne italiane sono inattive, contro meno di una su quattro della media dei venticinque paesi dell'Unione Europea. Nella stessa fascia di età la differenza tra tassi di attività maschili e femminili raggiunge il 20%, contro meno della metà della media europea. In Italia, il 40% delle donne con almeno un figlio in età prescolare non lavora e tale quota è superata nell'Unione Europea solo a Malta, nella Repubblica Ceca e in Ungheria (dati Eurostat 2007). Tra le donne italiane con figli il tasso di occupazione è tanto più basso quanto maggiore è il numero dei figli: circa il 60% con un figlio solo, la metà per chi ne ha tre, contro oltre il 40% delle spagnole, inglesi, francesi e delle tedesche prolifiche, e contro l'irraggiungibile 76% delle svedesi (dati Ocse 2008)

Figura 3: Forza lavoro, Tasso di partecipazione femminile (stime ILO, donne con età compresa tra i 15 e i 64 anni, valori percentuali)[1]



Fonte: KILM, Key Indicator of the Labour Market - ILO, International Labour Organisation -

3.3 La rivoluzione bloccata: l'ineguaglianza dei tempi familiari

Rispetto alla condizione media delle donne europee, le donne italiane sono letteralmente oberate di lavoro familiare. Secondo la più recente (2008-9) indagine ad hoc sull'uso del tempo, in Italia il 76% del tempo dedicato al lavoro familiare è sulle spalle delle donne e, soprattutto, poco è cambiato da quando le donne sono entrate nel mercato del lavoro: oltre venti anni fa, quando furono raccolti i dati della prima indagine (1988), era l'85%; nel 2002, per la seconda indagine, il 78% (ISTAT 2010). I cambiamenti sono lenti e la divisione dei ruoli ancora molto rigida, anche quando la donna lavora a tempo pieno. In Italia insomma, una donna o madre lavoratrice non significano un partner o padre collaborativo. Nelle coppie italiane, la modalità prevalente è quella dove tutto il tempo di cura dei figli è svolto dalla donna (41% delle coppie) o comunque oltre i tre quarti del tempo di cura (il 13% delle coppie). Anche per i lavori domestici la quota di tempo femminile è in oltre il 90% dei casi maggiore di quella maschile. Inoltre, in un quarto delle coppie, l'uomo non svolge alcun compito familiare. Gli effetti di questa ripartizione sbilanciata sono evidenti: tre donne su

[1] I dati mancati sono stati sostituiti come segue. Per l'Italia 1951 per 1950, 1961 per 1960, 1971 per 1970; per la Francia 1962 per 1960, 1968 per 1970; per il Regno Unito 1961 per il 1960, 1971 per il 1970.

quattro lavorano – sommando il lavoro dentro e fuori la famiglia – ben più dei loro partner e in oltre tre coppie su quattro le donne hanno meno tempo libero dei loro partner (Mencarini 2011).

I confronti sull'uso del tempo di donne e uomini in diversi paesi europei evidenziano che le differenze di genere sono particolarmente accentuate in Italia e che le donne italiane sono quelle più cariche di lavoro familiare. In tutti i paesi europei, infatti, le donne tra i 20 e i 74 anni spendono più tempo per il lavoro familiare che per quello extradomestico, ma le italiane hanno il record europeo con 5 ore e 20 minuti in media dedicate al lavoro familiare. All'estremo opposto le svedesi con 3 ore e 42 minuti in media. Il contrario si verifica per il lavoro retribuito: 2 ore e 6 minuti in media per le italiane, contro oltre 3 ore delle svedesi. Questo è ovviamente dovuto al fatto che in Italia lavorano meno donne. Il numero di ore di lavoro retribuito delle donne italiane è però simile a quello delle donne tedesche che invece dedicano 1 ora e 10 minuti in meno al lavoro familiare. All'estremo opposto, gli uomini italiani sono quelli che dedicano al lavoro familiare il minor tempo di tutta l'Europa (in media un'ora e trentacinque minuti, un'ora in meno degli svedesi), mentre dedicano più tempo di tutti al lavoro retribuito (ben oltre le 4 ore in media, insieme agli svedesi, quasi un'ora in più dei tedeschi). Anche se gli uomini lavorano più tempo delle donne fuori casa hanno però una maggiore quantità di tempo libero e ciò è dovuto alla minore quantità di tempo dedicato al lavoro familiare.

La ripartizione dei tempi di vita e dei compiti familiari svela quindi una profonda e radicata asimmetria di genere nell'ambito delle responsabilità familiari, che ovviamente influenza l'offerta di lavoro fuori dalla famiglia e la sua distribuzione nel ciclo di vita. In Italia le disparità tra uomini e donne in tutti gli stadi del corso di vita sono maggiori che negli altri paesi. La forte diminuzione di ore di lavoro per il mercato delle madri italiane e, viceversa, l'aumento di ore dei padri subito dopo la nascita di figli, non è riscontrabile in nessun altro paese, dove il lavoro per il mercato sembra indipendente dalla composizione familiare. L'Italia è anche l'unico paese dove il tasso di occupazione femminile non risale quando i figli sono più grandi (Anxo et al. 2011).

Nella fase familiare della vita di coppia con figli piccoli, i dati sull'uso del tempo ci mostrano quindi una forte specializzazione dei compiti fra uomini e donne italiane. Questa situazione riflette le difficoltà delle donne italiane a conciliare maternità e lavoro,dovute sia a fattori culturali, cioè ruoli di genere tradizionali con scarsa partecipazione ai lavori domestici da parte dei padri, sia alla presenza di rigidità nel mercato del lavoro e alla limitatezza dell'offerta di servizi di cura all'infanzia. Dal confronto con gli altri paesi europei emerge però chiaramente come, accanto al ruolo giocato dalle norme sociali e culturali (ad esempio un tempo più lungo per i pasti in Italia e Francia, Mencarini e Tanturri 2011), il complesso di politiche e di misure di welfare abbia avuto un impatto sull'eguaglianza di genere dei tempi di vita. Il welfare social-democratico, generoso e dichiaratamente perseguente l'uguaglianza di genere[1], come quello scandinavo, ha portato negli ultimi decenni, e di pari passo alla crescente partecipazione delle donne al mercato del lavoro, a diminuire molto le differenze di genere in tutti gli stadi del corso di vita. In Francia e Svezia, dove da lungo tempo sono implementate politiche efficaci di conciliazione e c'è un'offerta di cura per l'infanzia universale per bambini nei primi anni di vita, la maternità comporta solo una

[1] Il vice primo ministro svedese Westerberg, all'istituzione di un primo mese di congedo di paternità nel 1995 di cui fu responsabile, dichiarò: "La società è lo specchio della famiglia. L'unico modo per raggiungere l'uguaglianza nella società è di raggiungere l'uguaglianza in casa. Portare i padri a condividere il congedo parentale costituisce una parte essenziale di ciò".

temporanea riduzione delle ore lavorate da parte delle donne. In Italia, invece, la nascita di un figlio significa ancora l'uscita dal mercato del lavoro per una parte notevole di donne.

4 La bassissima fecondità come segno di inefficienza sociale

Letteralmente una rivoluzione è un rivolgimento, un mutamento profondo di una serie di caratteristiche che comportano la rottura di un modello precedente e il sorgere di un nuovo modello. Nelle società occidentali il più importante e diffuso cambiamento che ha rivoluzionato il sistema familiare, e quindi anche quello demografico, è proprio l'espansione dell'istruzione femminile. Questo ha creato inevitabilmente tra le donne nuove aspirazioni e preferenze per l'attività lavorativa remunerata e, di conseguenza, anche per il desiderio di combinare lavoro e famiglia, rompendo l'equilibrio della famiglia con ruoli di genere specializzati (*male breadwinner* e *female homemaker*).

I paesi che hanno fatto seguire all'aumento dell'istruzione femminile delle politiche che consentono di sfruttare da parte delle donne, ma anche da parte delle famiglie e della società, quest'istruzione femminile traducendola in occupazione qualificata, sono quelli che sono riusciti per così dire a completare la transizione e la rivoluzione verso un nuovo regime socio-demografico. Nel nuovo equilibrio caratterizzato da una maggiore uguaglianza di genere, l'alta istruzione e occupazione delle donne hanno portano all'autonomia economica femminile e alla riorganizzazione della vita e dei tempi familiari (Esping-Anderson 2009). Nei paesi dove non ci sono state tali politiche, la transizione non si è compiuta e le strutture di genere tradizionali sembrano prevenire e addirittura ostacolare le riforme necessarie che possono consentire alle donne di partecipare alla società e allo stesso tempo di formarsi una famiglia. Per usare le parole di Esping-Anderson (2009), la cultura di genere tradizionale è in questo senso la chiave della rivoluzione bloccata, l'elemento che impedisce di completarla, in un disequilibrio inefficiente dell'organizzazione familiare e del sistema di welfare, dove le difficoltà di conciliazione tra lavoro e famiglia finiscono per mantenere bassi livelli sia del tasso di occupazione femminile che di quello di fecondità. Per usare le parole di McDonald (2000), la cultura di genere tradizionale ha creato uno iato, con un'elevata percezione di non equità da parte delle donne tra gli alti livelli di eguaglianza di genere nel sistema di istruzione e i bassi livelli nelle famiglie, che ha come conseguenza la bassissima fecondità.

Mantenendo la prospettiva a livello macro, e quindi senza nessuna pretesa di individuare le relazioni causali tra i vari fattori in gioco, possiamo osservare la situazione attuale di alcune relazioni tra sistema di genere e la fecondità, che esemplificano quanto sopraddetto. Nella figura 4 osserviamo la relazione largamente positiva tra numero medio di figli per donna e gender gap. Nei paesi dove il gap di genere è più lontano dall'eguaglianza (rappresentato da un indice teorico pari all'unità) il tasso di fecondità totale è più basso. La posizione dell'Italia risulta la peggiore per combinazione tra fecondità e sistema di genere tra i paesi considerati. La figura 5 mette invece in relazione un indicatore di compatibilità percepita tra lavoro e maternità[1] con

[1] L'indice di compatibilità tra maternità e lavoro sintetizza, con il metodo delle componenti principali, quattro quesiti delle World Value Surveys, di accordo o meno con affermazioni riguardo la necessità di avere figli per la realizzazione della donne, sulla possibilità

la fecondità. L'indice di compatibilità, che dovrebbe catturare le norme sociali sull'uguaglianza di genere e sul ruolo delle donne dentro e fuori casa, è alto nei paesi nordici e anglosassoni, basso (con l'eccezione della Spagna) in quelli mediterranei e dell'est. Se lavorare e avere figli non è percepito come socialmente accettabile, i livelli di fecondità tendono ad essere più bassi (cioè è correlato positivamente con i livelli di fecondità). A completare il quadro delle relazioni macro con la fecondità, va ricordata l'ormai consolidata inversione di tendenza nella relazione fra fecondità e lavoro femminile, diventata positiva a livello aggregato (OECD 2011), per la quale sono i paesi con un tasso di occupazione femminile più elevato quelli con il numero medio di figli per donna più elevato. Quindi, tra i paesi europei dove vigono politiche più generose a favore delle donne lavoratrici (come nel Nord Europa) entrambi i tassi di fecondità e di partecipazione femminile al mercato del lavoro sono elevati; al contrario, nei paesi con sistemi di welfare meno generosi (quali quelli del Sud Europa) entrambi i tassi permangono a livelli molto bassi.

Dalla figura 6 si evidenzia come questo indicatore di compatibilità percepita tra lavoro e maternità sia anche correlato negativamente alla percezione dei legami familiari. Molti autori (si vedano ad esempio i saggi in Dalla Zuanna e Micheli 2004) hanno sostenuto che il modello culturale, familiare e demografico del sud del Mediteranno, storicamente diverso e familistico, mantiene sia dentro che fuori la famiglia una persistente ineguaglianza di genere e che, i legami familiari forti sono centrali nello spiegare le differenze di organizzazione dell'Italia, e del Sud Europa, rispetto ad altri paesi europei. Il sistema di welfare italiano sarebbe stato plasmato per adeguarsi ad una società basata sui legami forti (e non viceversa i legami familiari siano rinforzati dalla mancanza di protezione sociale e servizi di cura). Quali che siano le relazioni causali e le motivazioni storiche, il permanere della bassa fecondità e soprattutto di un numero minore di figli rispetto a quello voluto e desiderato, insieme alla bassa partecipazione femminile nel mercato del lavoro, possono oggi essere considerati un segno di disequilibrio e di inefficienza della società e contribuiscono, e contribuiranno sempre più, alla creazione di nuove disuguaglianze e di polarizzazione sociale di genitori e dei loro figli secondo il reddito e l'istruzione (Esping-Anderson 2009). Nonostante i timidi segnali di rialzo della fecondità in alcune regioni del centro nord (con, relativamente agli standard italiani, un alto tasso di partecipazione femminile e un maggiore disponibilità di servizi di cura all'infanzia) suggeriscano che la ricetta di crescita del lavoro femminile insieme ad adeguati strumenti di conciliazione è capace di far crescere anche la natalità italiana (Del Boca e Rosina 2009), le scelte recenti di politica sociale non vanno nella direzione tracciata, ma anzi, dichiarando di confidare ancora di più (se mai sia realisticamente possibile) in un welfare familista (ad esempio nel documento "Italia 2020"), sembrano aumentare la distanza tra l'Italia e il resto d'Europa.

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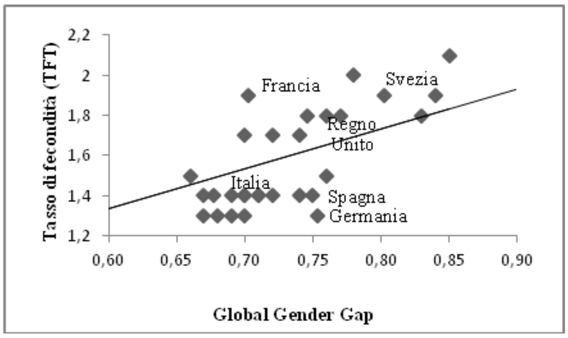
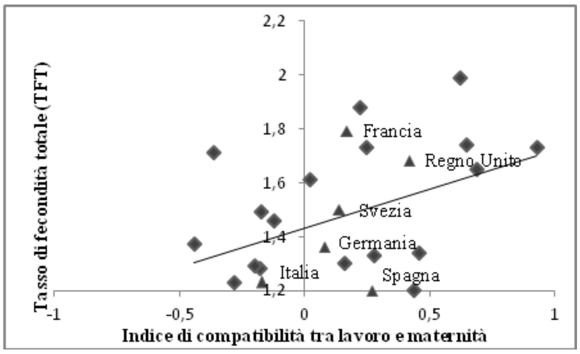
per una donna che lavora di stabilire una relazione con i suoi figli simile a quella di una donna che non lavora, sulla sofferenza di un figlio in età pre-scolare se la madre lavora; se quello che le donne vogliono davvero è una casa e dei figli. L'indicatore di "legami familiari" sintetizza, con il metodo delle componenti principali, tre quesiti sull'importanza della famiglia nella propria vita, sul rispetto per i propri genitori, sulle responsabilità dei genitori verso i propri figli (Aassve et al. 2011).

Figura 4: Rapporto tra il tasso di fecondità totale e l'indice del divario di genere nei paesi più sviluppati



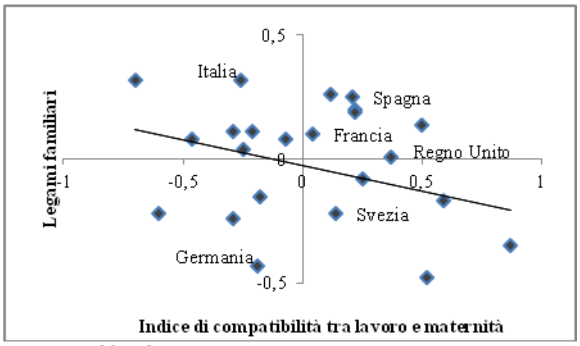
Fonte: Dati World Economic Forum e World Value Surveys 2010

Figura 5: Rapporto tra il tasso di fecondità totale e l'indice di compatibilità percepita tra lavoro e maternità nei paesi più sviluppati



Fonte: World Value Survey 2010

Figura 6: Rapporto tra i legami familiari e l'indice di compatibilità percepita tra lavoro e maternità nei paesi più sviluppati



Fonte: World Value Survey 2010

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The Semantic role of the variability in the development of statistical thought

Paola Monari

Abstract

Since the birth of modern sciences, the development of statistical thought has run along the evolution of the semantic concept of variability. The variability of the natural and social phenomena was the true challenge that Galilean science has faced substituting the order of scientific laws to the apparent disorder of facts. Those laws tried to combine two objectives: the explanation of phenomena in a causal context, and the forecasting of unknown events already explained by those laws. In the XX century, the most revolutionary scientific theories have been very powerful as explanatory models, but weak as predictive models with reference to single events. All this because the new theories were first of all statistical ones, for example, the theory of evolution for natural selection, the genetics of population or the quantum physics. Sciences learned to deal with statistic populations and collective properties. The intrinsic characteristics of this kind of laws were properties concerning a phenomenon as a whole, not its micro components that were seen as inessential. The scientific interest has shifted from the single one to the whole group by searching statistical regularities which are above all properties of the group.

1 The vindication of a plagiarism: Dedicated to Italo Scardovi

Addressing the issue of statistics' epistemological statements at a conference dedicated to the 150th anniversary of Italian statistics brings immediately to our mind the fundamental methodological contributions made by Italo Scardovi, one of the most notable representatives of the Italian school. From the 1970s onward, he was deeply involved with the epistemological understanding of the statistical method, first as a *modus intellegendi*, and after as a *modus operandi*. I dedicate to Italo Scardovi this essay based on his arguments, hoping to bring to the attention of dedicated scholars his fundamental reflections on methodology.

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2 The principle of classification: How to neutralize inherent variability

"*Nessun evento si ripete senza ridurre fatti a simboli, cose a idee, pluralità a tipologie. Sono queste le categorie della scienza.*" (I. Scardovi, Il tempo e il caso, Editore Martello, Milano, 1999).

From the birth of modern science until today, the development of statistical thought goes alongside the evolution of the semantic concept of variability. The variability of natural and social phenomena has been the challenge faced by Galilean science by replacing the apparent disorder found in nature with the order of scientific laws.

The need to investigate phenomena producing several different results has shifted the interest of scientific research from the individual case to that all cases. The search for laws concerning a group, considered as a whole, has found its empirical ground in the variability of reality, and of the phenomena that constitute it.

The first attempts to codify and justify the search for regularities within the apparent disorder of reality are very old and at the same time very contemporary. A reading of the "Platonic *idea"* in the language of modern science already introduces the concept of class, which is primarily a statistical one.

2.1 The gnosiological strength of classification

Scientific knowledge responds to the need for simplification with respect to the multitude of aspects and manifestations in which reality appears to our senses. Classifyin means to group together the single items that make up a population, according to similarities and differences, with respect to one or more characteristics, replacing the plurality of individual entities with the typological graduality of the classes. Through the principle of classification it is possible to understand the statistical properties of a sample only by considering as essentials the characteristics according to which similarities and differences are recognized, and by ignoring the many other characteristics that make the individual data appear heterogeneous [19].

In this attempt to define the classification process followed by modern science, much circularity emerges, which require us to accept a priori some concepts as postulates. We should define what a population is and which are its elementary constituents , what a phenomenon is and what are the relational properties in which it occurs, that is, the latent factors that determine empirical manifestations. This aim would lead us to an appealing field, but would leave us at the boundery of the issue that here we intend to face.

Nowadays, modern statistics adopts as a common and shared heritage, many of these concepts, such as "real phenomenon", "population", "class", "statistical unit", "elementary event", "characteristic" or "observable variable". Each of these concepts has been investigated by the greatest philosophers, from those of classical antiquity to the greatest statisticians of the twentieth century, who needed to establish their epistemological statements on the new sciences to which they provided their method by renewing it at the roots, beginning with the clarity of language.

The ability to classify is innate in human beings and in many animal species. Ordinary language itself has got it basis in classification. Within the common 'noun' is already expressed a classificatory identity that enables us to recognize individual objects or entities as the same, only on the basis of a few shared features deemed essential. We find again here the 'Platonic idea" that associates to each word a class, in itself homogeneous, of facts and things that are similar in some respects (principle of relative similarity), which allows us to recognize what belongs to the class and what is excluded. Speech is the first and most immediate form of abstraction-classification, which becomes analysis when it distinguishes different classes, and synthesis when it equalizes different objects within the same category.

The concept of class or category is essential to human survival and necessary for the development of modern science. However, it remains an abstract concept that does not bind reality into rigid schemes. Only actual facts, all different between themselves, exist. They may come and go at any time from the classes in which language, experience, or science has temporarily put them, to then form other classes.

2.2 The phenomenon, a necessary abstraction

The classification process realizes the epistemological rules for the classical experimental method, and extends its phenomenological sphere. At this point, however, we cannot neglect a term currently used by scientific language, which, together with the concept of category, contains all the strength and the semantic ambiguity of the statistical method. I mean the word *phenomenon*. Karl Pearson writes in the *The Grammar of Science* (1892, Chapter II): "(...) we have frequently spoken of the classification of facts as the basis of the scientific method , we also have had occasion to use the words real and unreal, and universe phenomenon. It is appropriate, therefore, that before proceeding further we should endeavour to clarify our ideas as to what these terms mean (…) But what are this facts in themselves, and what is for us the criterion of their reality" [16] . To approach the scientific concept of phenomenon we should revisit the classic Galilean experiment. It did not claim to reproduce reality, but a phenomenon, that is, a slice of reality that has been freed from everything that makes it unique and unrepeatable. The same happens when we observe a fragment of reality, even outside an experimental setting.

If, as the best dictionaries state, "a phenomenon is an observable fact or event, an item of experience or reality, a fact or event in the changing and perceptible forms as distinguished from the permanent essences of things", we must ask ourselves what is the implied relationship that transforms our perceptions into "facts" related to each others, so as to become inter-subjective and shared macro-concepts. When we define a phenomenon, this loses its historical context and becomes an idealized model that goes beyond contingency; it becomes a "conceptual artifact (observational or experimental)". Within this idealized model, all circumstances (facts or perceptions) unrelated to those of interest are considered irrelevant. Moreover, the variability induced by circumstances not connected to those considered "strictly related" to the phenomenon is eliminated because it is considered an element of disturbance.

The principle of classification is based on a set of relational connections that allow us to isolate what, according to our perceptions, are shared or shareable similarities from what are irrelevant differences, and as such are virtually eliminable. This process, certainly innate in human beings and consolidated by the need to survive in our natural and social environment, has developed into a rational ability that has led to classify perceptions into homogeneous classes (where variation between individual components is considered irrelevant) and into phenomena, i.e. sets of inter-connected categories. Compared to the concept of class, the concept of phenomenon includes a further abstraction that codifies within a closed system all the relational connections between certain categories of facts, according to a kind of centripetal force, and turns it into a *unicum*, precisely the phenomenon.

Modern science has refined these rational abilities and has widely analyzed the philosophical canons that lead from experience to abstract theory. In this context we find the ideal continuity between the statistical and the experimental method. But the path has been very long. Most modern science is based on the concepts of class (category) and phenomenon. Its roots dip into Aristotelian science and pre-Galilean Scholasticisms, which sought its authority in the most extreme classificatory “bulimia”. Redemption from those early classification schemes, tarnished by the contamination of ruling esotericisms, was achieved by Linnaeus with the *Systema Naturae* (1759), which goes beyond the creationist paradigm that had inspired it and definitely puts the principle of classification amongst the fundamental epistemological canons. Linnaeus deliberately ignored individual variation represented by gradual differences between individuals belonging to the same systematic group, in order to search for significant differences between groups. However, in order to be "scientific", Linnaeus needed “objective” criteria that would allow him to distinguish the classes (or species, using his language) between themselves. So he enunciated a first “objective” criterion that accounted for both similarities and differences: the species can be distinguished according to their ability to produce fertile offspring among themselves, but not with individuals of other species. Linnaeus’ classificatory system is still one of the pillars of modern taxonomy, and its essential schematic pattern has given the initial theoretical basis for the Darwinian Theory of evolution by natural selection [19].

If the statistical method, together with the experimental method, is the rational foundation of modern sciences, it accompanies the development of major scientific bodies, both in phases of normality, and in those of transformation. Also, on alternate phases, all the sciences have taken advantage from the strategies offered by statistical science, and in turn, statistics made use advantage from the discoveries of other sciences: first astronomy, then biology, physics, psychology, genetics, social sciences, economics, etc. It is a matter of fact that the entire methodology has developed around the many facets in which variability is expressed.

Initially, the aim was to neutralize it to look for invariants. Founded on the basis of the principle of classification, statistical methods dealt with means and moments, frequency (probability) distributions that best fitted real data, dependence and regression analysis between characters to look for causal links [6].

Moreover, the principle of classification coherently suggested statistics to identify the different types of variability that science began to put in evidence. Following Karl Pearson and Ronald Fisher, statistics has built very powerful methods for breaking down variability to compare the (systematic) variability between groups and the (accidental, random) variability within groups. Subsequently, variability was employed to search for the relations that make a phenomenon a complex concept that can be described by logical or functional relations between its basic components. We can think about analysis of variance, correlation analysis, exploratory factor analysis, structural equation models, generalized latent variable models, etc.

Spearman was certainly inspired by the works of Pearson on correlation and its analytical representation[15][17] to formulate his ”factor analysis”[7] [23]. A statistical method that, once again, lent the most appropriate language to psychology when it was searching for its epistemological statements to give demonstrative strength to its theories and thus come closer to the other positive sciences [18].

3 Combinatorial system, induced variability and probability

"*Il metodo sperimentale e la matematica del certo hanno condotto il sapere scientifico alla scoperta degli invarianti del mondo naturale, nei secoli della grandi conquiste, così il metodo statistico ha accompagnato il pensiero naturalistico alla ricerca di nuovi invarianti: gli invarianti emergenti dalla probabilità*" (I. Scardovi, Statistica come metodologia delle scienze naturali, Accademia Nazionale dei Lincei, 1975).

In the history of the scientific thought, as well as in human history, the concepts of variability and uncertainty have often been associated. They are very different from each other, but also very intertwined, so as to be often confused.

The variability of the physical world has forced man to create coping strategies to find regularities, to make predictions. How is the world beyond our observational perspective, beyond the present time? In this way, rational thinking has conquered the concept of scientific law as an extreme abstraction to explain the way of 'being and becoming' of the physical and natural world.

The rational man has learned very quickly to address variability by seeking similarities, recurrences and repetitions, i.e. the underlying regularities to be found in that part of sensory experience which we call a phenomenon.

It has been more difficult dealing with uncertainty, which is a product of variability, but which concerns the single fact, the individual occurrence. In the distant past as well as today, fortune tellers, oracles, astrologers, magicians have always brought relief to the worries of human beings. Nonetheless, uncertainty has always been a challenge, a mind's creative moment that has manifested in the games of chance [12].

One of the first objects intended for this purpose were *astragali* (small sheep or dog's anklebones). They have been identified by prehistoric archeology as the most ancient instruments invented by man for games of chance, and have subsequently been widely cited by ancient historians or represented in graffiti, murals, and decorated vases[4]. Subsequently, with a decisive leap in abstraction, the *astragali* were replaced by dice, artifacts with which man has tried, perhaps unconsciously, to shape a very sophisticated ideal concept, that of symmetry, with which he claimed to ensure each of the six faces of the die an equal possibility to appear in each throw. The die becomes the symbolic representation of an immutable physical object, which becomes variable when it is used.

Even in an irrational way, man becomes the creator of variability. He has learnt to create variability in order to challenge it. That of the dice it is not a phenomenal variability, but pure mental abstraction. You may very well play dice without dice, just think about all possibilities and pick one.

Therefore, man was familiar with gambling games and with uncertainty in the results. Why, then, still in ancient times, was not born a mathematical science of games that could anticipate modern probability theory in the same way as the forms of the physical world have inspired Euclidean geometry. Many answers have been suggested, all unsatisfactory. We have to take a long step forward in time in order to find the first attempts at describing the possible outcomes of gambling games such as throwing dice or coins, attempts that became the empirical premise for the modern combinatorics. These attempts, however, still did not mention any measures of potential combinatorial macro-states, seen as aggregations of micro-states (elementary events) that produce the same synthetic result, the outcome (success or failure) of the game.

The history of scientific thought recognizes Luca Pacioli's *Summa de arithmetica, geometria, proportioni et proportionalità* (1494) and Gerolamo Cardano's *De ludo* *aleae* (1501-1576), as the forerunners of a new formal language able to describe the space of events in a random experiment, whose dimension is much broader than the few elements that generated the experiment [8].

It is not surprising then, to find the simplest representation of the possible states of a dice game in the wonderful essay written by Galileo, *Sulla scoperta dei dadi* (1635), where the founder of modern science shows the possible combinations of points in the throw of three dice, whose sum is equal to or less than 10. Galileo's treatise is exemplary for its clarity and generalization. It also shows a simple table to illustrate the number of combinations (micro-states) that lead to the same total result (macro-state). Uncertainty could therefore be measured in a rudimentary form consisting of the distribution of all possible events; form that anticipated the concept of random variable. Awareness of the randomness of events introduces a new rational outlook to the interpretation of the variability of real phenomena, which can be ideally represented by gambling games, in the same way as the perfect shapes of Euclidean geometry represented physical objects. These "real" transpositions of abstract concepts (mind experiments or simulations) have offered to a multitude of scholars the intuitive hook to understand the rational foundations of probability and its theorems [9].

So from combinatory, it is born the idea of a new variability that is no longer the one of the real phenomena, but comes only from the speculative ability of the mind. This new idea of "random variability" is an absolutely brilliant and subversive product of the rational thinking that has revolutionized science.

From the work of Cardano, however, almost one hundred years had to pass for Pascal (1654) to be able to see in those combinatorial schemes the logical premises of his probability theory. In the language of combinatorics, which is completely deterministic and mathematical, Pascal also found the easiest language to explain to the scientific world the power of his new logic, that of probability. It was a language that did not scare scientists of those times because combinatorial variability remained governed and governable by man, it was a playful mind game that had nothing to do with the reality of phenomena. It remained completely subjugated to that which will become Laplace’s determinism, in which probability was confined to neutralize the effects of accidental errors in measurement, in order to search for the "true" value of the observed magnitude.

In that "neutral" context, the first probabilists managed to demonstrate fundamental theorems, just think about De Moivre, Lagrange, Bernoulli, and Gauss [8][9][24].These leading figures of modern thinking, however, were not only mathematicians; they were above all physicists and astronomers, and their philosophical speculations were strongly influenced by sensory experience. Gauss (1809) drew his famous model in a purely analytical way, after assuming some formal preconditions, which he had taken from the evidence regarding the distribution of repeated measurements of astronomical magnitudes, following an entirely circular logical path. That evidence had already led Lagrange (1806) to indicate the arithmetic mean of instrumental measurements as the most likely value for an unknown quantity. And he did so, even before the adventurous inversion of De Moivre’s theorem would have generated the ambiguous confusion with the law of large numbers, logically resolved only with modern statistical inference.

However, for many years, probability continued to be convenient to compensate for the human mind’s cognitive limitations, a mind that could never compete with the “infinite intelligence” postulated by Laplace.

But the subtle workings of this new logic and its language were broadening the possible horizons of scientific thinking. Once identified a phenomenon, this could be described by a statistical model able to interpret and manage both the "accidental" variability that differentiates between individuals, and the "systematic" variability that characterizes the phenomenon in its essential trait.

In applying the binomial law to human characteristics, Quetelet (1869) states that we need to study the species and not the individual, because only within the species we can find the wonderful collective regularities. He writes: "Of all the wondrous laws that nature connects to the conservation of the species, I think I can put in the forefront that of the conservation of the type" [20]. Thus Quetelet gives a quantitative dimension to Linnaeus' taxonomy and opens new possibilities to the natural sciences, which begin to become quantitative. But in those years there was much more going in the life sciences' field.

4 The return match of variability

"*Variability therefore became the image of nature and man, and the analysis of variability became the method which allowed a scientific knowledge*" (I.Scardovi, Chance and order in a statistical picture of life, Epistemologia, 1983)

In 1859 Darwin had already published *On the Origin of Species,* and formulated his theory of evolution by natural selection, which offers to science a new way of reading the variability described by deterministic models. The species are not fixed but they evolve conditioned by the environment [2]. Beyond its ethical and philosophical impact, which has not yet diminished, this theory opened up two huge issues: (1) to prove the Darwinian theory in quantitative terms, and (2) to find the process that determine the phenotypical changes upon which the environment could act selectively.

The first issue permits, once and for all, the rise of the statistical method with the fundamental works of Galton, Pearson, and Weldon jointly with the journals that have launched statistics in the world as a unifying method of modern sciences: *The Journal of the Royal Statistical Society* and *Biometrika.* Pearson writes in *The Grammar of Science* (1892): "The unity of all science consists alone in its method, not in its material."

Variability is no longer a state of disorder to be eliminated in order to find the true laws of nature, but is in itself a source of knowledge. The laws of the physical world can be discovered only by studying the variability of its phenomena, namely the set of relationships that represent a logical connecting system of the observed facts.

In this context, it originates the theory of linear regression in which settles implicitly the concept of causality, and that of linear correlation, where the concept of cause fades into a state of interdependence. The latter offered to Karl Pearson [17] and then to Spearman [6], the idea of a latent explanation underlying observed phenomena, the so-called factors, in a constant pursuit of a deep causal system.

The principle of causality could not yet be abandoned by the positive sciences in the nineteenth century, but began to be questioned.

The second issue relates more closely to scientific research and, in particular, biology in its new structure, which is that of genetics. Mendel (1866) had the brilliant idea of the genetic inheritance of characters, expressed in the simplest and most schematic form of a diallelic gene from the expansion of Newton's binomial formula $[p(A) + p(a)]^n$, where the exponent indicates the generations, *A* and *a* refer to the dominant and recessive alleles that determine the phenotype, while the numerical coefficients of the binomial formula define the numerical proportions of genotypes and phenotypes.

The theorem's structure at the basis of the representation of the hereditary process experimentally demonstrated by Mendel, and by those who came after him to codify molecular genetics and population genetics, is the basic one of the toss of the coin, which is based on the aggregation of micro-states (the possible combinatorial outcomes) in macro-states (all the combinations that produce the same expected result)[13] [14]. The combinatorics and variability that result from this, become *modus intellegendi* of a new science that finds in the ancient gambling the most appropriate language to provide semantic, and at the same time formal content to the explanation of its processes.

If analogy has a place in the evolution of scientific thought, then we can understand the growth process of Ronald Fisher, who, starting from the discovery of the life sciences, was led to his extraordinary contributions to methodology [13]. One can safely state that Karl Pearson and Ronald Fisher have founded modern statistics and, perhaps, the events that have contributed to see them as opposites, have also helped to sharpen their speculative thinking. [18]

Looking for his autonomy in research and due to his professional interests, Fisher gave an original layout, perhaps final, to population genetics [4], on which more recent contributions are still based on. He created a theorem, by blending the Darwinian theory of evolution by natural selection and the Mendelian genetics. In his argument, the odds that determine genetic combinations became statistical frequencies, properties that do not relate to the individual but to the population.

From this huge work summarized in more than 400 pages, what has modern statistics taken, beyond the strength of the method? The answer is: a new way of dealing with variability. The arithmetic mean is no longer the final point of a science that seeks above all the invariants. As a model of invariant distribution, the arithmetic mean becomes the starting point to investigate variability. Standard deviation is no longer the worrying measurement of dispersion or the reassuring measurement of precision. The analysis of variance breaks new grounds because it allows recognizing the variability within groups as a sign of a system in equilibrium, from the variability between groups, as sign of significance of the differences between groups. The analysis of variance allows recognizing phenomena that change, as were changing Darwin's species when they were subject to different environmental conditions. Fisher brilliantly associated the first type of variability to that of combinatorial schemes, generated by constant probabilities, and translated it into the language of random sampling, where variability is just sampling error. On the other hand, he associated the second type of variability to the one that occurs when an innovative factor breaks the balance and changes the original connections (parameters, probabilities, etc.). This entirely new perspective of variability has completely transformed modern statistics, which became much more than a mere tool for quantitative research; it became the explanatory language of the new sciences [13].

The extraordinary potential of the statistical method had already been apparent by Karl Pearson, both in his philosophical speculations in the *Grammar of Science* [16], and in the work on the correlation analysis, which represents the complementary and precursory contribution to Fisher's work [5].The age gap between these two great scholars does not change the overall brilliant result that emerged.

5 Time and variability

"*Ma quale futuro? Un futuro che è dato o che si darà? Un futuro necessario, già scritto, come un destino dovuto? O il futuro di un divenire non univoco, di un destino che viene scritto nel momento in cui si compie*?" (I. Scardovi, Il tempo e il caso, Ed. Martello, 1999)

Modern science had to wait for the Twentieth century to acknowledge that time is an intrinsic factor in the variability of phenomena. There is the variability expressed by the uncertainty of a future event since the conditions that regulate the phenomenon are unknown. Here time is inert, and uncertainty about the future is the same as in the unknown past. And there is the variability that instead is created and shaped by time. Time becomes a factor of variability because it intervenes to provide a direction to the phenomena that evolve, in the same way as evolutionary turning points mark the time. When this variability intervenes, time becomes irreversible and phenomena cannot return to their previous state (in the sense that the probability of this happening is 0).

The dominant Laplacian philosophy confirmed and strengthened the thesis that the order of the universe was fixed at the origin, and could remain unchanged and unchangeable, in astronomical phenomena as in life phenomena. There is no history in Newton's sky, where the planets follow their unchanging path over the centuries. There is no history in the life forms that Linnaeus made immutable in the genera and the species. Phenomena without history. The future is all contained within the past, as Laplace wrote in his famous philosophical essay on probabilities: "We ought then to regard the present state of the universe as the effect of its anterior state and the cause of the one which is to follow. Given for one instant an intelligence which could comprehend all the forces by which nature is animated and the respective situation of the beings who compose it – an intelligence sufficiently vast to submit these data to analysis – it would embrace in the same formula the movements of the greatest bodies of the universe and those of the lightest atom; for it, nothing would it uncertain and the future, as the past would be present to its eyes." [9].

Laplace's thinking has influenced all of modern science, which had strenuously tried to fight the first signs of weakness when, in the second half of the nineteenth century, Charles Darwin disrupted all research canons through a dynamic and evolutionary explanation of natural variation in which time is beaten by the clock of the generations that pass. Darwin's concept of time is a time measured along the direction imprinted by environmental factors on the combinatorial variability of genetic crosses in the passing of generations. For the first time, a time that does not allow return is established. In the same way in which time in Boltzmann's physics did not allow any logical return [1].

The issue of prediction is then open. In an entirely deterministic world, all events could be predictable. If they are not so, it is just because we do not have the "infinite intelligence" that would allows us to know at any given moment all the forces by which nature is moved. For centuries this has allowed humans to foresee large astronomical phenomena, and to classify a living being into its species. Here uncertainty is only a limit of the researcher's skills, which does not remove semantic value from scientific law, and the variability of single components is only a factor of disturbance. Prediction of an individual case becomes possible only through cognitive approximation, but it could be exact.

The new science of Darwin and Boltzmann is not like this anymore, it shows another world that is indeterministic and that can only be explained with the language of probability. The living species are no longer immutable, but become a continuous interlaced web of genetic combinations, of contingent factors, and environmental contexts. Thus, although individual molecules follow the laws of classical physics, a population of molecules follows other rules that are statistical-combinatorial and that lead that population toward the most probable state of maximum entropy, driven only by random combinations of elementary events. In support of this statement, it is famous the behavior of the fleas of Paul and Tatiana Ehrenfest's dog. Boltzman calls this process "molecular chaos" and demonstrates its irreversibility with a simple measurement of entropy [1]. With time, the term "case" enters scientific explanation; the "case" may be the contingent and extraordinary event that changes the course of phenomena's physical and natural history and, as such, is unpredictable; or it can be the event that may be coming true in the convergence of micro-states toward a stable macro-state.

Once again, the statistical method lends its semantic language and acquires new tools: new measurements for variability in terms of entropy, formalisation of stochastic processes, time series' analysis techniques that break down a phenomenon that changes over time in all its possible components. These, incidentally, presents the same types of variability of phenomena that are indifferent to time. The only difference is the statistical representation of that variability, which gives an ontological role to time only when it changes state and separates accidental differences within the time intervals that are conventionally defined by the systematic differences between periods produced by a time that becomes active [19] .

6 Statistical laws and revealing variability

"The discovery of natural variability, of its role and its genesis accounts for the methodological novelty of the scientific thought induced by the crisis of deterministic science and by the assertion...of a statistical image of reality." (I.Scardovi, Chance and order in a statistical picture of life, Epistemologia, VI (1983)

With its empirical rationality Galileo pictured a nature that could be described through a mathematical language (today we would call it statistics), in which qualities could be converted into quantities. This was the kind of science used in astronomy, an observational science that could only emulate the parameters of the Galilean experiment. Moreover Galileo wanted to establish a way of thinking free from metaphysical prejudice and anchored in experience. Galileo's rationality is that of Kepler, of the great astronomers who came before him, and those who followed him until Newton. The laws of astronomy were looking for regularities within the intricate web of variability in the movements, sizes, space and, above all, of measurements. Those laws were to interpret the divine plan, but also had to convince people with accuracy in the predictions of major celestial events.

The laws of Galilean science planned to combine two objectives: (a) to explain phenomena in a causal context, and (b) to predict events not yet explained by those laws. The statements of modern science have not always achieved both objectives. On the contrary, the most revolutionary scientific theories of the twentieth century were very powerful as explanatory models, but often very weak as forecasting models when applied to single events. This is because the new theories – from the theory of evolution by natural selection to population genetics and quantum physics - are first of all "statistical" theories. Science has learned to deal with statistical ensembles and collective properties.

The characteristics of these laws are properties that relate to the phenomenon as a whole and not to its basic components and, as such, deemed inessential. Scientific interest shifts from single units to groups in search of statistical regularities which then become group properties. The proportion of gender at birth in humans is a feature of the species, it does not apply to a single birth; in the same way as the second law of thermodynamics does not refer to a single molecule or a small sample of molecules, but it describes the possible states of a large set (population) of molecules. The genetic theory of heredity too does not allow determining with certainty how the next person will be, but it accurately describes the genetic structure of a group.

It seems that here we can find the difference between the Newtonian theory of celestial gravitation, which allows predicting with precision the various astronomical events, and the theory of population genetics that can describe all the genetic frequencies of a group, but cannot describe the individual. Even this difference, often emphasized by current epistemology, is now largely outdated. In the infinitely vast time scales of astrophysics, the planets' movements lose their uniqueness and blend in, in the same way a molecular cloud.

What are the conditions according to which a statistical property, a regularity, a distribution of frequency observed in a group may free themselves from the group dimension to become parameters of a population, scientific laws and theories? The law of large numbers attempted to answer this. The answer is not a mathematical theorem, nor a scientific discovery; it is the expression of man's rational ability to find rules in the repetition of its experiences and perceptions. The repetition of experiences and observations in order to search for regularities is a common feature of scientific research, whatever the factual or epistemological context in which it takes place. The distinction between absolute (totalitarian) laws and statistical laws, which has so animated the philosophical debate in the last centuries, it is solved statistically in identifying phenomena with no variability from phenomena consisting of several different elementary events in which the variability between single units cannot be eliminated.

In absolute laws (totalitarian or individual) every single experience, every individual characteristic is representative of the whole category, that is the law. Just one observation is logically sufficient to express the law. The replication of experiences is not required to bring out the law, but only to convince the observer of the invariance of his observations. The discovery that a pure water molecule is composed of H_2O becomes a categorical statement: all molecules of pure water are like this. Each molecule identifies all the others and becomes an abstraction, a scientific category.

This is not the case in statistical laws, in which the replication of experience is a necessary condition to bring out the regularities implied in the variability of individual constituents. A statistical property is revealed by the number of observed cases.

To recognize statistical regularity, the extent of observed data must extend until an underlying law emerges by inertia. This extent depends, once again, on the variability of the phenomenon. The more a phenomenon is variable, the larger must be the number of observations for its collective characteristics to stabilize. Mendel wrote: "Real numerical laws can only result from a large number of individual cases, the larger their number, the easier it will be to eliminate accidental irregularities" [14]. Similarly, Boltzmann describes the swarms of its molecules: "... you always have to take into account a greater number so that, from a certain point on, its further increase becomes irrelevant" [1].

When the phenomena that are of interest to science are "statistical", variability becomes the key explanation and acquires its own semantic meaning. The macro-phenomenon is statistically regular because it is the result of many irregular micro-phenomena: order emerges from disorder. This means going beyond the single phenomenon and looking for a different perspective. The physical sciences have shifted their attention to macro-phenomena in a more agile and less absorbing way than life sciences and social sciences.

The first epistemological consequence is that every semantic distinction between sample and population blurs when the sample is large enough to bring out the law; in the same way as, faced with a statistical statement, the distinction between validation and confutation blurs [21][22]. In these laws, the analysis of the phenomenological variability in its typologies becomes the main focus of scientific research, and statistical methodology plays a main role and is no longer just a tool. Statistical language becomes the language of these new theories, and the statistical for the study of variability in all its facets offer the interpretive keys for all phenomena, as well as the conceptual tools to follow the evolution of a phenomenon through the transformations of its internal variation or its entropic system.

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On reading speed and accuracy, to contrast dyslexic and normal children readers in Italy

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1 Introduction

The act of Parliament n. 170 (approved the 8th October 2010), on "the new statutory law for learning disorders affecting the scholastic population" states that dyslexia is a physical disturbance, of neurobiological origin, which makes it very difficult to learn to read, to write and to perform calculations for intelligent children who do not have any other types of disorder. According to this act, teaching to a dyslexic child within the school should respect the pace and the learning methods of the individual and should include a system of assessment that takes into account the different performances of the child. The early detection of dyslexic children in elementary school is currently based on a test that identifies individuals showing impaired reading speed and/or accuracy on a list of words and a list of nonwords. The variables used in this procedure are the number of erroneous spellings and the number of syllables read in a second. To measure the speed of reading, some authors have suggested the total time (in seconds), in place of the number of syllables read in a second (Lorusso *et al.*, 2006). For variables monitoring the speed of reading, the threshold values for which a student is considered as a normal reader, as a child with impaired reading or with heavy impaired reading, have been specified on the basis of the mean and the variance (estimated on a very limited sample), assuming a normal distribution (Sartori *et al.*, 1995, 2007). In this work, we show that these thresholds do not seem to be trustworthy, since in our study the variables are found to be far from the Gaussian and the means and the variances that we have obtained are statistically different from the means and the variances presented in the litera-

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ture. Drawing from the results obtained by giving different tests of reading to about 1500 students in elementary school, the purpose of this work is threefold:

- Study the empirical distributions of the variables currently used for measuring the accuracy and the speed of reading and discuss the validity of the thresholds.
- Introduce a new screening procedure which is exactly 1 minute long. In this test the students are asked to read a specific text for exactly one minute.
- Introduce a new composite indicator which takes into account both the speed and the accuracy of reading.

2 Main results of the study and the new composite indicator

About 1500 students in elementary school, in the Emilia Romagna region (Italy), where given two tests of reading. In the first test, that is currently used for contrasting dyslexic and normal children readers in Italy, the students are asked to read a specific list of words and a specific list of nonwords. The variables monitored are:

X_1: time (in seconds) in reading the list of words,
X_2: number of syllables per second read in the list of words,
X_3: number of erroneous spellings in reading the list of words,
X_4: time (in seconds) in reading the list of nonwords,
X_5: number of syllables per second read in the list of nonwords,
X_6: number of erroneous spellings in reading the list of nonwords.

The second test is a new one that we would like to propose as a screening protocol for specific learning disorders in elementary school. It is exactly one minute long. If this test is found to be reliable, it can be reproduced in a homogenous manner throughout the country and, allowing much saving in time, it may be given to all students, for the early identification of dyslexic readers and the early scheduling of targeted teaching interventions. In this test the student is asked to read a text for exactly one minute. The variables monitored are:

Y_1: number of words read in a minute,
Y_2: number of syllable per second read in a minute,
Y_3: number of erroneous spelling in a minute.

Table 1 reports some descriptive statistics. In each class, the pairwise correlations between variables are all significantly different from zero (α=0.001), with the exception of the correlations between Y_3 and each of the other variables. For what concerns the speed of reading (X_1, X_2, X_4, X_5), statistics reported in Table 1 show that these variables are far from the symmetry and the normality. Three non parametric tests (Shapiro-Wilk, Anderson-Darling and Jarque-Bera) lead to the conclusion that these variables are not Gaussians ($\alpha = 0.001$). Many outliers (values higher than $x_{0.75} + 1.5(x_{0.75} - x_{0.25})$ or smaller than $x_{0.25} - 1.5(x_{0.75} - x_{0.25})$ affect these variables and have an impact on the sample mean and the sample variance. Using the T-test for the means and the non parametric test of Levene for the variances, both

	X_1					X_2					X_3				
Class	I	II	III	IV	V	I	II	III	IV	V	I	II	III	IV	V
N. of subjects	333	384	200	276	276	333	384	200	276	276	333	384	200	276	276
Min	92	69	52	50	43	0.24	0.47	0.97	0.80	1.36	0	0	0	0	0
Max	1148	595	289	348	206	3.04	4.06	5.38	5.60	6.51	84	55	18	19	22
$x_{0.25}$	232	135	90	73	64	0.66	1.20	1.92	2.59	3.11	5	4	2	1	1
Median	314	177	110	89	74	0.89	1.58	2.56	3.16	3.78	10	6	4	3	2
$x_{0.75}$	424	234	146	108	90	1.21	2.08	3.12	3.84	4.38	17	10	6	5	4
Mean	360	198	121	96	79	0.98	1.67	2.59	3.20	3.77	14	8	4	4	3
Standard deviation	190	89	44	34	23	0.48	0.66	0.81	0.89	0.91	12	7	4	3	3
Coeff. of variation	0.5	0.4	0.4	0.4	0.3	0.49	0.40	0.31	0.28	0.24	0.9	0.9	0.8	0.9	1.1
Skewness	1.7	1.5	1.3	2.5	1.8	1.48	0.74	0.34	0.16	0.03	2.1	2.6	1.3	1.6	2.5
Kurtosis	3.3	2.8	1.8	12.3	5.5	3.32	0.41	-0.16	-0.22	-0.18	6.0	11.9	1.9	3.6	8.9
	X_4					X_5					X_6				
Min	58	49	33	34	31	0.23	0.41	0.60	0.54	1.07	0	0	0	0	0
Max	542	311	210	234	118	2.17	2.57	3.82	3.71	4.06	38	31	20	24	27
$x_{0.25}$	120	89	69	58	50	0.62	0.92	1.29	1.47	1.73	4	5	3	3	2
Median	151	110	84	72	59	0.83	1.15	1.51	1.76	2.14	8	7	6	5	4
$x_{0.75}$	204	137	98	86	73	1.05	1.42	1.83	2.14	2.52	13	10	8	8	6
Mean	173	120	88	74	63	0.33	0.37	0.49	0.53	0.62	7	5	4	4	4
Standard deviation	82	45	30	24	18	0.33	0.37	0.49	0.53	0.62	7	5	4	4	4
Coeff.of variation	0.5	0.4	0.3	0.3	0.3	0.38	0.32	0.31	0.29	0.29	0.7	0.6	0.6	0.8	0.8
Skewness	1.8	1.6	1.4	2.2	0.6	0.54	0.45	0.83	0.72	0.69	1.3	1.2	1.1	1.3	1.9
Kurtosis	3.8	3.5	2.7	11.5	0.0	0.38	0.24	1.87	0.65	0.17	1.7	2.0	1.4	2.0	6.0
	Y_1					Y_2					Y_3				
Min	8	21	48	9	57	0.30	0.78	1.77	0.32	2.07	0	0	0	0	0
Max	127	157	164	180	180	4.23	5.25	5.53	5.98	5.98	9	10	6	11	11
$x_{0.25}$	30	54	77	108	127	1.10	1.97	2.77	3.63	4.23	0	1	1	1	1
Median	41	66	97	125	146	1.48	2.38	3.33	4.18	4.87	1	2	2	1	1
$x_{0.75}$	53	81	115	140	164	1.95	2.90	3.86	4.65	5.53	2	3	2	3	2
Mean	43	69	98	124	144	0.68	0.77	0.73	0.81	0.79	1	2	1	2	2
Standard deviation	20	24	24	27	25	0.68	0.77	0.73	0.81	0.79	1	2	1	2	2
Coeff. of variation	0.5	0.3	0.2	0.2	0.2	0.44	0.31	0.22	0.19	0.16	1.1	0.9	0.8	0.9	1.0
Skewness	1.2	0.6	0.2	-0.4	-0.8	1.06	0.45	-0.09	-0.34	-0.69	1.8	1.3	1.0	1.8	2.3
Kurtosis	2.9	0.4	-0.7	0.9	0.4	2.10	0.20	0.68	1.04	0.05	4.8	3.0	1.1	5.5	8.6

Table 1 Descriptive statistics. Variables X_1-X_6 are currently used to contrast dyslexic and normal children readers in elementary school. Variables Y_1-Y_3 are the new ones proposed in this work.

the means and the variances, in classes II, III, IV and V, result significantly different (α=0.05) from the values reported in Tressoldi *et al.* (2007), that are estimated on smaller samples and have been used to define the thresholds. Regarding class I, this is the first study analyzing the behavior of students in a reading test. The thresholds are obtained as $M(X)+2S(X)$ (for X_1 and X_4) and as $M(X)-2S(X)$ (for X_2 and X_5), where M indicates the mean and S the standard deviation, considering that in a Gaussian distribution these values exclude about the 2% of the population. Variables Y_1 and Y_2 are not normal distributed and presents outliers, as well. For this reason, we define the thresholds in terms of median and the interquartile range and we let these values to be equal to $x_{0.5}-1.5(x_{0.75}-x_{0.25})$. In our sample, the percentages of students with values outside the threshold are:

Class	X_1	X_2	X_4	X_5	Y_1	Y_2
II	7.8%	0.5%	5.7%	0.0%	1.8%	1.8%
III	3.0%	0.0%	4.5%	0.5%	0.0%	0.0%
IV	2.5%	1.1%	1.4%	0.7%	4.3%	4.0%
V	2.2%	0.7%	1.1%	0.0%	4.0%	2.2%

For X_1, X_2, X_4 and X_5, the the percentages are far from the nominal value. Moreover, even if all pairs of variables are highly correlated, with these thresholds the number of students that are screened differently is relatively high: 42 (considering X_1 and X_2), 51 (considering X_1 and X_4), 46 (considering X_1 and X_5), 35 (considering X_2 and X_4), 6 (considering X_2 and X_5), 35 (considering X_4 and X_5). With Y_1 and Y_2 the percentages of subjects classified as impaired reader are more in agreement with the percentage estimated by the Italian Dyslexia Association, around 4% of the scholastic population. Moreover, the number of students that are screened differently with these two variables, in our sample, is equal to 6 and is relatively low. Regarding the accuracy of reading, the threshold values for X_3 and X_6 have been set equal to $x_{0.95}$. The tabulated values in Tressoldi *et al.* (2007) are similar to the values obtained in our sample. For Y_3, we chose the threshold $x_{0.5} - (x_{0.75} - x_{0.25})$. The percentages of students classified as impaired readers are as follows. In class I: 4.0% (with Y_3). In class II: 2.9% (with X_3), 4.4% (with X_6), 2.3% (with Y_3). In class III: 1.5% (with X_3), 4.0% (with X_6), 2.5% (with Y_3). In class IV: 4.3% (with X_3), 9.4% (with X_6), 3.2% (with Y_3). In class V: 3.6% (with X_3), 4.0% (with X_6), 3.2% (with Y_3).

In each class, the scatter plots matrix of Y_1, Y_2 and Y_3, clearly shows un-correlation and also independence between the variable measuring accuracy and any of the variables measuring speed. For the couples Y_1, Y_3 and Y_2, Y_3, the sample points are distributed about the center of mass in a spherical manner. Speed and accuracy seems to be two different factors of the phenomenon dyslexia. An explorative principal component analysis confirms this idea: the first component is highly correlated with Y_1 and Y_2 and explains the 67% of the total variance; the second component is uniquely correlated with Y_3 and explains the 33% of the total variance. Choosing Y_1 for the speed, we then propose the following composite indicator:

$$MD = ((Y_1 - M(Y_1))/S(Y_1))^2 + ((Y_3 - M(Y_3))/S(Y_3))^2,$$

For each observation, MD is the Mahalanobis distance from the center of mass of the sample points in the 2-dimensional Euclidean space spanned by Y_1 and Y_3. Since Y_1 and Y_3 are un-correlated, MD coincides with the Euclidean distance calculated on the z-scores. If Y_1 and Y_3 were Gaussians, observations with the same value of MD will have the same density in the bivariate normal distribution and $MD \sim \chi^2_{g=2}$. In defining the threshold, we may consider the value T for which $P(\chi^2_{g=2} \leq T) = 0.05$.

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Linking Administrative Tax Records and Survey Expenditure Data at the Local Level

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Abstract This paper focuses on the combination of administrative tax records and survey data collecting information on household expenditures. We considered the sample survey on household expenditures conducted by the Milan Municipality and the Chamber of Commerce of Milan (wave 2007-2008) and the tax register matched to the local population register in the data warehouse AMeRIcA, concerning residents in Milan in 2007. The purpose is to enrich the information stored in the two data sources.

1 Introduction

Household surveys supplement information on income, expenditures, demographic characteristics and are available at national and subnational level. However, unless a survey which includes all the relevant variables for the aims of a specific research, administrative data can be used to supplement this lack of information on the variables of interest. When a research requires information available in different data sources (i.e., survey and administrative sources) the linkage of data records stored in different sources can lead to more detailed statistical analysis than ones based on information provided by each source separately. In this paper, we combine two archives belonging to different data sources containing, among others, the main monetary proxies of well-being: income and consumption. Both sources, a sample survey and an administrative register, regard the municipality of Milan. The first dataset is the sample survey on family expenditure (ICFM hereafter)[2] conducted by the Milan Municipality and the

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[2] ICFM stands for "Indagine sui Consumi delle Famiglie nel comune di Milano".

Chamber of Commerce of Milan (wave 2007-2008). This survey refers to a sample of 808 families resident in Milan. The second dataset collects administrative records regarding the entire population resident in Milan and covers the 2000-2007 period. The data derive from tax records matched to the local population register in the data-warehouse AMeRIcA.[3] In 2007, we have 653,686 family records.

2 Linkage Procedure

The situation we face is where households belonging to the survey are sampled from the administrative source. Therefore the first dataset is, on principle, included in the second. A possible source of violation of the above statement could be mainly information recorded at different times, such as births or deaths after the interview for the survey has been made or residential mobility acknowledged only by the population register. Literature offers mainly two tools for data linkage: probabilistic linkage and exact (or deterministic) linkage (see Gill, 2001). In this study, we adopt a deterministic approach to record linkage. Exact linkage is feasible when both datasets contain the same variable or characteristic available for all units, fixed, easily recordable, verifiable and unique to that individual (Gill, 2001). In our case, exact linkage would not be feasible due to the absence of a unique identifier. Since we could not identify a set of variables that, compounded, substitute the unique identifier, we resort to almost-exact linkage as defined by Gill (2001) by relaxing the exact linkage criterion a little. We use then the number of variables that agree (at least three) to establish if the record pair should be linked. This method does not explicitly provide for possible links; however, possible links occur if a criterion establishes that a record of an archive could be linked to at least two records of the other archive. Therefore, in our linkage exercise we provide for three types of outcome: matches, possible matches and non matches. After comparing the various variables recorded in the two data sources, we have singled out four variables suitable for our linkage exercise on households: Enumeration Area, Type of Family, Age Code and Sex Code.[4] We organize the selected variables in four criteria, each of them excluding one variable at a time. In practice, we closely follow Jenkins et al. (2008) procedure also to have a basis for comparison. It should be stressed, however, that differently from the above authors, we maintain throughout the paper the "possible matches" category among our outcomes. The main advantage of this procedure is that using compound keys (or criteria) allows for some success in linkage and at the same time the exclusion of one variable in turn allows for assessment of their discriminating power. The four criteria we use in our linkage exercise are: Criterion 1 (C1): Enumeration Area, Age Code and Type of Family; Criterion 2 (C2): Enumeration Area, Sex Code and Type of Family; Criterion 3 (C3): Type of Family, Sex Code and Age Code; Criterion 4 (C4): Enumeration Area, Sex Code and Age Code. We first run the four criteria independently and secondly combine the criteria in a hierarchical matching (HM) process, divided into two steps. In the first step, HM consists of

[3] AMeRIcA ("Anagrafe Milanese e Redditi Individuali con Archivio") is managed by the Statistics Department of the University of Milan-Bicocca on the behalf of Milan Municipality.

[4] Age Code and Sex Code are two artificial variables assigned to each household. The former reports ages of all family members in increasing order; the latter is given by the sex of all family members ranked by increasing age.

applying a given criterion C*i* to the possible matches detected by another criterion, C*j*, applied before C*i* (henceforth, such a sequence of criteria is denoted by C*j*+C*i*). In the second step, C*i* is applied to non matches detected by C*j*. We apply HM separately for possible matches and non matches to isolate the capability of the second criterion to solve uncertainties (possible matches given by the first criterion) and to correct non matches identified by the first criterion.

Table 1: *Linkage rates for ICFM households*.

	matches		possible matches		non matches		all
Independent matching	n	%	n *(to N)*	%	n	%	n
C1	509	63.0	91 *(254)*	11.3	208	25.7	808
C2	138	17.1	584 *(9,299)*	72.3	86	10.6	808
C3	204	25.3	476 *(338,624)*	58.9	128	15.8	808
C4	562	69.6	57 *(143)*	7.1	189	23.3	808
Pooled matching	615	76.1	149	18.4	44	5.5	808
HM on possible matches							
C1+C2 or C1+C4	541	67.0	57 *(143)*	7.1	210	26.0	808
C1+C3	526	65.1	73 *(307)*	9.0	209	25.9	808
C2+C1 or C2+C4	535	66.2	67 *(166)*	8.3	206	25.5	808
C2+C3	390	48.3	247 *(6,049)*	30.6	171	21.2	808
C3+C1	468	57.9	124 *(494)*	15.3	216	26.7	808
C3+C2	369	45.7	259 *(6,149)*	32.1	180	22.3	808
C3+C4	473	58.5	114 *(428)*	14.1	221	27.4	808
*HM on non matches**							
C1+C2	567	70.2	169 *(1,230)*	20.9	72	8.9	808
C1+C3	537	66.5	159 *(23,105)*	19.7	112	13.9	808
C1+C4	584	72.3	57 *(143)*	7.1	167	20.7	808
C2+C1	551	68.2	67 *(166)*	8.3	190	23.5	808
C2+C3	393	48.6	252 *(6,070)*	31.2	163	20.2	808
C2+C4	553	68.4	67 *(166)*	8.3	188	23.3	808
C3+C1	485	60.0	124 *(494)*	15.3	199	24.6	808
C3+C2	387	47.9	291 *(6,314)*	36.0	130	16.1	808
C3+C4	498	61.6	114 *(428)*	14.1	196	24.3	808
C4+C1	584	72.3	59 *(147)*	7.3	165	20.4	808
C4+C2	585	72.4	155 *(1,272)*	19.2	68	8.4	808
C4+C3	571	70.7	134 *(37,233)*	16.6	103	12.7	808

Notes: linkage rates are calculated as a proportion of the ICFM survey (n=808). The column entitled "possible matches" reports in brackets the number of records in AMeRIcA *(N)* possibly matching the n records in the ICFM survey. In HM, criteria are applied in order of appearance.
* Results include the matches gained through HM on possible matches.

2.1 Main Results and Future Research

Table 1 reports linkage results both in absolute values and as a fraction of the ICFM survey. Table 1 is divided into three main panels. The top one refers to linkage according to single criteria and to the pooled linkage obtained using at least one of the criteria. The central panel reports linkage results obtained by applying HM on possible matches. The bottom panel reports further matches resulting from application of HM on non matches. Among the four independent criteria, C1 (composed of Enumeration Area, Age Code and Type of Family) and C4 (composed of Enumeration Area, Sex Code and Age Code) return linkage rates remarkably larger than the remaining two. In particular, the best results are provided by C4 with a linkage rate of 69.6% while C1 matches 63% of the records, both expressed as a fraction of the ICFM survey. On the one hand, this suggests that Enumeration Area and Age Code are the outstanding variables in our linkage exercise. Comparing the column of possible linkage rates of C2 and C3 confirms the noticeable discriminating power of Enumeration Area versus Age Code since lack of the first leads to the largest ratio between the number of records in AMeRIcA to be possibly matched to ICFM survey records and the number of the corresponding ICFM records (711 to 1 for C3 vs almost 16 to 1 for C2). Turning now to the results of HM on possible matches, we observe that rates corresponding to application of any criterion after C4 are not reported in Table 1 because there was no further match to be counted. On the contrary, we can see that in the remaining cases applying a second criterion solves many uncertainties, leading to better matching rates especially for C2 and C3. The worst rates are obtained, as expected, from combination of C2 and C3 independent of their application order, confirming their low discriminating power. From the bottom panel of Table 1, we notice that the best rate is achieved by running C4 after C1 (C1+C4) with a linkage rate of 72.3% and the lowest number of possible matches.

We add that linkage rate varies between subsamples defined by type of family. The lowest rates are achieved for singles and couples without children. Since our almost-exact linkage mainly relies on demographic variables concerning family members, the lower the number of family members the lower the discriminating power of the compounded variables Age Code and Sex Code. This aspect may introduce selection bias which should be taken into account when analysing linked data. Future research will be devoted to compare the results obtained in this study with those provided by probabilistic linkage (Jaro, 1989). This approach explicitly provides for possible links and estimates of linkage error rates. We aim at combining these alternative approaches to review our preliminary results and adjust for false matches and false non matches.

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Famiglie e generazioni: tra vecchi patti di solidarietà e nuove forme di disuguaglianza

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Abstract

In questo saggio si propone una rilettura critica di come si è configurato nel corso del secondo dopoguerra il sistema di welfare italiano e di come esso si è coniugato con le specificità, antropologicamente radicate, del sistema familiare e della natura dei legami tra genitori e figli. Un assetto che, nei primi trent'anni del dopoguerra, è stato in grado, in buona misura, di tenere assieme sviluppo economico, coesione e mobilità sociale.
Nei trent'anni successivi tutto questo si è invece progressivamente deteriorato. Le trasformazioni socio-economiche e demografiche dagli anni Settanta in poi non sono state accompagnate da un ripensamento del sistema di welfare pubblico in grado di aiutare le famiglie e i singoli a cogliere le nuove opportunità e a difendersi dai rischi emergenti. A vecchi squilibri si sono aggiunte così nuove disuguaglianze. L'Italia è diventata così un paese sostanzialmente bloccato sia dal punto di vista economico che sociale, non in grado di valorizzare le proprie risorse, incapace di incentivare comportamenti virtuosi con ricadute positive per la collettività. Rispetto alle altre economie avanzate, negli ultimi decenni il nostro paese è stato, in particolare, meno in grado di rendere conciliabili fecondità e lavoro femminile, di migliorare le condizioni dell'infanzia, di rendere autonomi i giovani e promuoverne la partecipazione nel mercato del lavoro, di ristrutturare in senso attivo le fasi più mature del corso di vita e di affrontare in modo adeguato la crescente domanda di assistenza verso i grandi anziani.
Queste difficoltà non agiscono per tutti e ovunque allo stesso modo. L'obiettivo di questo saggio è mettere in luce come su rischi e opportunità del nuovo secolo continuino a dominare, spesso inasprendosi, disuguaglianze territoriali e di status sociale che si intrecciano dinamicamente con quelle di genere e generazionali.

1. Il welfare state italiano: dai Trenta Gloriosi alle riforme degli anni '70

A partire dalla fine della seconda guerra mondiale e fino alla metà degli anni '70, durante il cosiddetto Trentennio Glorioso (1945-1975), il welfare italiano ha conosciuto, come la maggior parte degli altri Paesi in Europa, un periodo di progressivo sviluppo. Agli inizi degli anni '80, l'Italia poteva a buon diritto vantare un livello di copertura nel campo della protezione sociale pari a quello degli altri Paesi appartenenti alla Comunità europea (Ascoli, 1984; Ferrera, 1984). Anche la spesa durante questo periodo crebbe a ritmi sostenuti. Nel 1981 la spesa pubblica come percentuale del PIL superò la soglia del 50% e la percentuale della spesa sociale arrivò al 30% (Jurado e Naldini, 1996, fig. 1).

Nel campo delle politiche per la famiglia, gli anni successivi al dopoguerra, si pensi agli assegni familiari, furono caratterizzati dalla graduale estensione del numero di categorie beneficiarie (Saraceno, 2003) ma dalla loro progressiva perdita di valore sociale. L'introduzione della legge di maternità nel 1950, seppure migliorasse la condizione delle madri lavoratrici, lasciava senza protezione un numero molto alto di donne occupate nel mercato (tutte le lavoratrici a domicilio). In Italia i diritti sociali delle donne, mogli e madri, negli anni '50 e '60 rimasero "deboli" e/o di tipo "derivato", ossia venivano acquisiti dalle mogli in virtù della loro posizione di dipendenza (Naldini, 2003). L'istituzione delle Regioni e il decentramento territoriale contribuirono in modo decisivo al processo di crescita che ne seguì. Gli anni '70 furono, infatti, gli anni della progressiva estensione della cittadinanza sociale a categorie rimaste fino ad allora escluse, non solo donne, ma anche i giovani, oltre che gli anni della progressiva democratizzazione delle relazioni familiari. Sul piano sociale importanti furono la legge del 1971 n. 1204 sulle lavoratrici madri, e la legge n. 1044 che istituisce gli asili nido finanziati con risorse pubbliche. Il 1978 è poi l'anno dell'introduzione del servizio sanitario nazionale. Si trattò di grandi conquiste sociali anche sul piano dei diritti civili che hanno sancitoil tramonto definitivo della famiglia basata sulle asimmetrie di genere almeno da un punto di vista giuridico. Nel 1970 viene introdotto per la prima volta nel nostro ordinamento il divorzio, nel 1975 venne varata la riforma del diritto di famiglia e nel 1977 venne introdotta la legge di parità.

La crescita dei Trenta Gloriosi e le conquiste degli anni '70 mostrava però diversi limiti e molte misure sociali continuavano a disegnare un welfare profondamente diviso per genere e generazione.

In particolare le donne, ancora poco presenti nel mercato del lavoro, ricevevano diritti sociali di "serie b", i giovani italiani, a differenza di quelli di altri Paesi europei, si vedevano negare il diritto ad un sostegno al reddito quando in cerca del primo lavoro.

La crisi petrolifera del '73 segna lo spartiacque tra un prima, caratterizzato, appunto dall'espansione, e un dopo, di crisi e di restrizioni progressiva, originata dalla crescente inadeguatezza delle vecchie soluzioni di fronte a nuovi problemi (fine della piena occupazione, invecchiamento demografico, ecc.). In verità sia il modello "universalistico" di welfare state, dei paesi scandinavi, sia il modello "occupazionale" (vedi Ferrera, 1993) poggiavano su una serie di premesse socio-economiche e politiche istituzionali che erano state alla base di quello che Colin Crouch (1999) ha chiamato "il compromesso di metà secolo" e che vengono meno nel corso dei cambiamenti economici, sociali e culturali degli anni '70. In primo luogo, entrambi i modelli di welfare si basavano sulla piena occupazione e su un'economia in crescita. D'altra parte, anche l'economia fordista si fondava su un preciso modello di famiglia, basata sul matrimonio stabile e su una rigida divisione dei ruoli, su quello che è stato definito il modello del "male breadwinner" (Lewis, 1992; Crompton, 2006). L'aumento e la permanenza delle donne nel mercato del lavoro sono i fattori che più di altri hanno contribuito, sotto la spinta propulsiva delle riforme degli anni '70, ad incrinare il patto "implicito" su cui si reggeva il modello di famiglia basato sul *male breadwinner*

2. Familismo non sostenuto, impoverimento e disuguaglianze sociali

L'isitituzionalizzazione e il consolidamento del welfare state italiano si sono contraddistinti nel panorama europeo per alcune peculiarità (Jurado e Naldini, 2008). Innanzitutto, il welfare italiano si è distinto per unsistema "dualistico" di protezione sociale che ha dato una limitata protezione sociale a chi non è inserito nel mercato del lavoro "stabile" (Ferrera, 1996). [1] In effetti, fin

[1] «Il modello di welfare lavorista italiano, nato per ridurre la disuguaglianza economica fra le classi sociali, emerge forse come il più problematico, per la sua tendenza a favorire l'aumento della disuguaglianza sociale fra inclusi ed esclusi» (Barbieri 2005, 175).

dall'inizio il sistema di assicurazione sociale è stato destinato a compensare i rischi della vecchiaia e quelli a cui è esposto il *male breadwinner*, riservando una protezione marginale a tutti gli altri individui, in primo luogo, donne e giovani (Naldini, 2003). Alti tassi di disoccupazione, diffusi maggiormente tra donne e giovani, larga presenza di imprese familiari, di lavoratori autonomi e di lavoro informale e nero hanno contribuito a produrre evidenti squilibri di genere e generazione nel sistema di protezione sociale pubblico.
In secondo luogo, Sebbene il welfare state italiano abbia raggiunto livelli di spesa per pensioni sopra la media europea, scarsi quando non inesistenti sono le politiche a sostegno del costo dei figli, quellea sostegno delle famiglie con bisogni di cura e le politiche a sostegno del reddito e di contrasto della povertà.
In effetti possiamo dire che nel nostro paese, a differenza di altri paesi, per esempio la Francia e più recentemente la Germania, è assente un quadro coerente e organico di misure destinate a sostenere le famiglie con figli, o le famiglie con persone fragili o non autosufficienti (Naldini e Saraceno, 2011). Le politiche familiare italiane si contraddistinguono per essere un ambito di intervento marginale, quando non assente, sia se guardiamo ai trasferimenti monetari alle famiglie, soprattutto alle famiglie con figli, sia se guardiamo ai servizi per la prima infanzia. In termini di trasferimenti monetarie la percentuale di spesa pubblica destinata alla famiglie con figli raggiunge nel 2005 il valore del 1,1% del PIL contro un valore medio per l'Europa a 27di 2,1% (Eurostat 2008, tab.3).
Per quanto riguarda i servizi per l'infanzia, i dati più recenti mostrano che anche nelle regioni e nei comuni dove la copertura dei servizi per la fascia d'età 0-3 è più elevata, questa rimane ben al di sotto della soglia del 33%, fissata nell'agenda di Lisbona; mentre i servizi per i bambini in età 3-6 anni o in età pre-scolare non sempre sono a tempo pieno. Secondo i dati dell' indagine censuaria sugli interventi sociali dei comuni (Istat, 2010) il tasso di copertura dei nidi d'infanzia pubblici conteggiando anche i servizi integrativi rivolti ai bambini in fascia 0-2, si attesta nell'anno 2008 intorno al 12,7% a livello nazionale. Restano ampie le differenze territoriali, tra Sud Italia, con percentuali di copertura che variano tra il 2,7% della Calabria e il 9,8% dell'Abruzzo e le regioni del Centro Nord, ove le percentuali variano tra più del il 28% in Emilia Romagna e Valle d'Aosta e, rispettivamente, il 14 e il 16% in Piemonte e Lombardia (Istat, 2010). Tuttavia, quando entrambi i genitori lavorano i nonni sono e restano la principale soluzione di cura e di conciliazione tra famiglia e lavoro (Istat-Cnel, 2003).
Negli ultimi anni l'unica rilevante innovazione nell'ambito delle politiche di cura nei confronti dell'infanzia riguarda la redistribuzione delle responsabilità di cura entro la famiglia, tra padri e madri, e l'allargamento del riconoscimento di queste responsabilità anche a figure di familiari diverse dai figli piccolissimi (Naldini e Saraceno, 2011). La legge 53 del 2000 riconosce per la prima volta il diritto-dovere dei padri a dare cura e prevede la possibilità di congedi di cura non solo per i figli ma anche per la cura di altri familiari. La legge, mentre riserva ai padri una quota di congedo che viene persa se essi non lo prendono, introduce anche un incentivo per loro – un "permesso premio" di un mese di cui potranno usufruire se fruiranno del congedo per almeno tre mesi. Stante anche lo scarso compenso previsto, la legge 53 non ha significativamente aumentato nella pratica il numero di padri che ne beneficiano. Il tasso di utilizzo da parte dei padri del congedo genitoriale nel nostro Paese è basso e non supera il 7% degli aventi diritto e solo il 4% dei restanti padri con almeno un figlio sotto gli otto anni ha intenzione di usufruirne nel futuro (Istat-Cnel, 2003).
In effetti, in Italia, i nonni sono la principale soluzione alla conciliazione, quando entrambi i genitori lavorano, soprattutto se lavorano con un contratto o con un orario "atipico" (Naldini e Saraceno, 2011). Un elevato ricorso ai nonni come principale soluzione alla conciliazione famiglia-lavoro presenta diverse criticità. In primo luogo, questa soluzione ha nel lungo periodo una limitata sostenibilità, viste le trasformazioni demografiche, lavorative femminili e l'innalzamento dell'età pensionistica. In secondo luogo, esso rappresenta un'opportunità assai diversificata tra chi ha una rete parentale relativamente giovane e disponibile e chi non ce l'ha, così come tra chi ha le risorse economiche per accedere al mercato privato dei servizi e chi no.

Ancora più delle politiche sociali per l'infanzia, in Italia sono le politiche di cura per gli anziani fragili a risultare scarsamente sviluppate e fortemente frammentate tra diversi ambiti di intervento,entro un quadro istituzionale che definisce le responsabilità verso familiari e parenti in modo molto esteso (Millar e Warman 1996; Naldini e Saraceno, 2008). Come è stato osservato, proprio in questo settore di *policy,* il nostro Paese mostra un'eccezionale "inerzia" legislativa (Pavolini e Ranci 2008). Soltanto alcune Regioni hanno introdotto riforme e fondi per il finanziamento degli interventi per la "non autosufficienza" ma manca una legge-quadro a livello nazionale e soprattutto mancano i finanziamenti. Non sorprende dunque che i servizi di cura per gli anziani fragili, residenziali e domiciliari, restino limitati (Da Roit e Naldini, 2010).
Entro questo quadro, caratterizzato, da un lato, da scarse politiche sociali e, dall'altro, da una stagione di cambiamenti che hanno visto in primo luogo protagoniste le donne, si sono sviluppate nuove strategie familiari dal basso. In altri termini, nonostante l'assenza di riforme nel campo delle politiche per gli anziani (o forse proprio a causa di ciò) è questo il settore che ha conosciuto una rilevante trasformazione, con crescita, a partire dagli anni '90, del mercato della cura privata a domicilio, alimentato dalle "nuove" ondate migratorie femminili (Catanzaro e Colombo, 2009). Le famiglie, e in particolare le donne in essa, restano tuttavia le principali responsabili della cura dei familiari disabili e soprattutto degli anziani fragili, anche nella variante della "famiglia-con donna-migrante" (Bettio, Simonazzi e Villa, 2006; cfr. anche Naldini e Saraceno, 2008; Da Roit e Naldini, 2010).
Oltre ad un ruolo marginale riservato alle politiche per la famiglia, sia in termini di trasferimento monetario che di servizi di cura, il nostro Paese si caratterizza per avere riservato una forte marginalità all'investimento nelle politiche socio-assistenziali, così come a tutte quelle politiche che aiutano le persone nei momenti di assenza di reddito, ossia, alle politiche di contrasto della povertà. L'Italia rimane l'unico Paese nella Comunità Europea (insieme alla Grecia) a non aver previsto uno schema di sostegno al reddito di tipo universale. Infine, in Italia il tasso di povertà minorile è più elevato che in altri Paesi occidentali e la principale ragione risiede proprio nell'assenza di misure universalistiche che sostengano le famiglie con figli (Revelli, 2010).
D'altra parte, limitate, quando non assenti, sono in Italia anche le politiche a sostegno dell'autonomia dei giovani (si pensi al fatto che in Italia non esiste niente di analogo al *revenu minimum d'insertion* francese, né la disoccupazione spetta ai giovani in cerca di primo lavoro). Il welfare italiano per lungo tempo si è basato sulla forza della solidarietà familiare e intergenerazionale, il welfare italiano, cioè, si è fondato sulla protezione sociale offerta dalla famiglia.
Un'ultima peculiarità del welfare italiano, che lo accomuna con il resto dei Paesi del Sud dell'Europa (Jurado e Naldini 2008) è data dalle politiche abitative che a lungo hanno privilegiato l'acquisto della casa in proprietà. In effetti, in Italia, solo il 6% degli appartamenti sono in affitto contro una media europea del 18% (Trilla, 2001).

3. Dinamiche riproduttive: le scelte al ribasso delle famiglie italiane

3.1. Dall'Unità agli anni Cinquanta

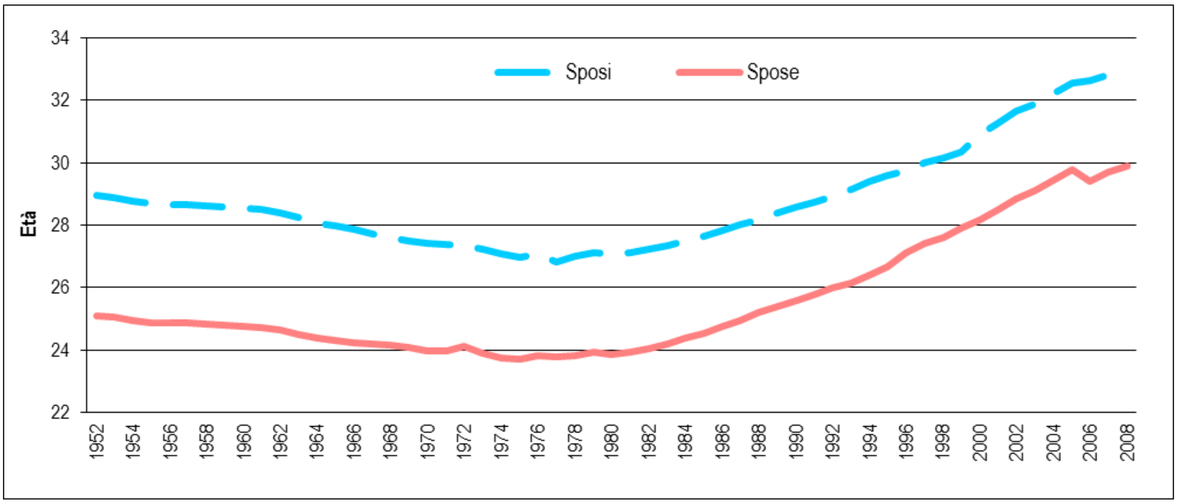
Le particolarità del welfare italiano sono strettamente legate alle dinamiche del processo riproduttivo. L'evoluzione della fecondità del nostro Paese ha seguito varie fasi, passando dai livelli molto elevati del passato ai persistentemente bassi valori attuali. Al momento dell'Unità la demografia italiana rifletteva ancora le condizioni dell'antico regime demografico. Solo nei decenni successivi inizia la "Transizione riproduttiva", processo di diffusione di nuovi comportamenti che porteranno la fecondità dagli alti livelli del passato ai bassi valori attuali. Come mostrano gli studi di demografia storica, il processo di declino si diffonde seguendo tre direttrici: dai ceti sociali più istruiti a quelli meno istruiti, dalla città alla campagna, dal nord al sud.

L'industrializzazione favorisce il diffondersi, in strati sempre più ampi della popolazione, del modello di famiglia borghese, formato da pochi figli sui quali i genitori investono molto, sia dal punto di vista affettivo che economico. Da un lato, infatti, i figli - con la diminuzione della funzione produttiva minorile e l'imporsi dell'istruzione obbligatoria - sono meno remunerativi in età precoce, aumentano inoltre i costi di allevamento e la durata di dipendenza dalla famiglia di origine. Dall'altro, le nuove possibilità di mobilità sociale che la società industriale apre inducono i genitori ad investire più sulla qualità di pochi figli che sulla loro quantità.
Negli anni '50 la Transizione riproduttiva viene considerata pressoché conclusa in larga parte dei paesi occidentali, compresa l'Italia o quantomeno l'area centro-settentrionale. Anziché però stabilizzarsi attorno ai due figli per donna la fecondità conosce una fase di crescita, nota come "baby boom", che tocca l'apice nel nostro paese nella metà degli anni Sessanta. La crescita economica del dopoguerra apre una fase di fiducia nel futuro. Le nuove generazioni, sul versante maschile, si trovano con aumentate possibilità di diventare autonome grazie alle nuove opportunità di lavoro e reddito offerte da un paese che sta accelerando verso l'industrializzazione. Tutto ciò consente di raggiungere in età relativamente giovane i mezzi per poter mantenere una propria famiglia. Allo stesso tempo le giovani donne sono desiderose di sposarsi presto, per uscire dalle ristrettezze e dalla rigidità della famiglia di origine e mettere le basi di una vita domestica più moderna, resa meno grigia e pesante dai nuovi strumenti tecnologici (come la lavatrice, l'aspirapolvere e la televisione) e dalle nuove possibilità di consumo. L'esito è un aumento dei matrimoni, una diminuzione dell'età degli sposi e un incremento delle nascite. Il *baby boom* arriva al suo apice nel 1964, anno in cui nascono in Italia oltre un milione di bambini. Si tratta, in assoluto, del numero più elevato di figli della storia della Repubblica italiana.
Siamo nel pieno del modello tradizionale di famiglia borghese, che prevede l'uomo, marito, padre lavoratore responsabile pressoché unico del benessere economico della famiglia ("breadwinner"), e la donna, madre, moglie e casalinga, responsabile esclusiva delle relazioni di cura. Una famiglia solidamente unita dal vincolo coniugale, ma anche molto tradizionale: caratterizzata da rapporti di genere ed intergenerazionali nei quali dominava la figura del capofamiglia maschile. Indiscussa era infatti la subalternità sociale e giuridica della moglie e dei figli rispetto al marito-padre. Questo modello culturale, in combinazione con un quadro congiunturale favorevole (quello della ricostruzione e del boom economico), produce quella che è stata definita come "l'epoca d'oro del matrimonio" (Saraceno 1996).

3.2. L'ostinata resistenza del modello male breadwinner e le sue implicazioni

Con la fine del baby boom iniziano a manifestarsi i primi segnali di una stagione di nuovi cambiamenti, che investono fortemente anche il modo di fare famiglia, la vita domestica e le relazioni familiari. In Italia sono le generazioni che entrano in età adulta a partire dal 1975 a diventare protagoniste di una fase che combina in modo accentuato sia riduzione della fecondità, sia la posticipazione dei tempi di transizione alla vita adulta ed in particolare del matrimonio (Fig. 1; Rosina 2004).

Fig. 1 - Evoluzione dell'età media al primo matrimonio in Italia



Fonte: Istat

Uno dei fattori principali del cambiamento è la crescente scolarizzazione e partecipazione femminile al mercato del lavoro favorita anche dalla terziarizzazione. I prolungati tempi del percorso formativo portano ad una posticipazione della formazione della famiglia. D'altro canto, secondo l'impostazione di Becker (*"new home economics"*) la crescente autonomia in ambito economico attraverso il lavoro remunerato riduce il vantaggio femminile che deriva dal matrimonio. Ciò porta alla crisi del modello tradizionale di famiglia borghese che prevedeva una forte asimmetria di genere con l'attività dell'uomo esclusivamente dedicata al mercato e quella della donna alla famiglia e all'attività di cura. Assieme alla crisi di questo modello si riducono i tassi di nuzialità, in particolare in giovane età. Si riduce, in una prima fase, anche la fecondità prima dei 30 anni (Billari, Rosina 2007).

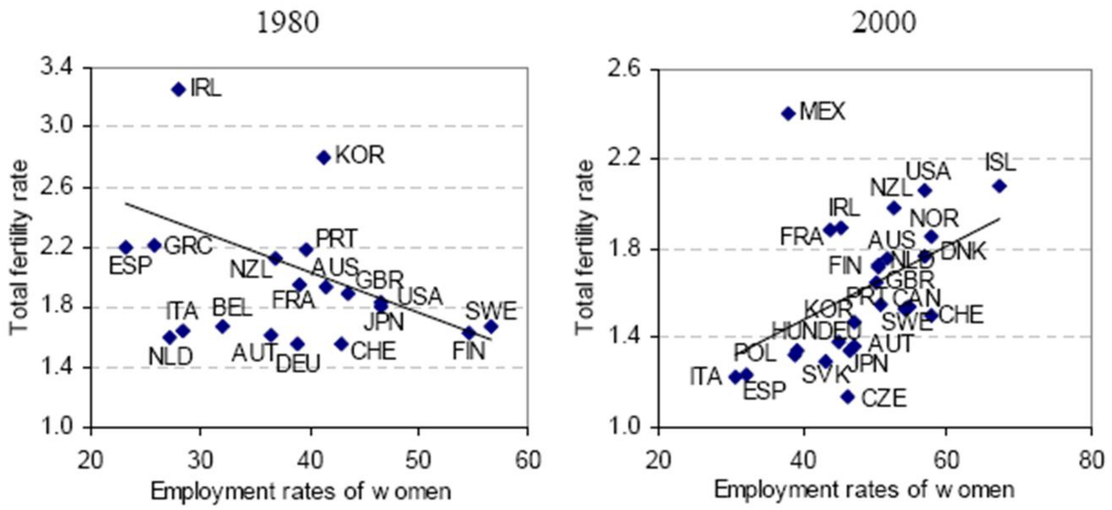
Assieme e in relazione alle forze strutturali alla base del mutamento del ruolo femminile dentro e fuori le mura domestiche, si innescano anche altre *driving forces* del cambiamento, di ordine più profondo, che attengono alla sfera valoriale e "ideazionale". In particolare la teoria della "seconda transizione demografica" richiama l'attenzione sul processo di progressivo aumento dell'autonomia individuale in ambito etico, religioso e politico. Oltre che sempre meno disposte a limitare la propria libertà, le nuove generazioni diventano anche sempre più insofferenti nell'adottare, in età troppo giovane, comportamenti che implicano assunzioni di impegni e responsabilità, con conseguente tendenza ad evitare di fare scelte percepite come irreversibili, o comunque troppo vincolanti (Micheli 2008), come il matrimonio e la genitorialità.

Mutamenti di ordine strutturale e culturale che producono, appunto, conseguenze rilevanti sui tempi e modi di formazione di una propria famiglia. Va notato che i paesi, come quelli scandinavi, che per primi sperimentano questi cambiamenti sono anche i primi a vedere la fecondità scendere sotto i due figli per donna. Ma allo stesso modo, i paesi che riadattano e ristrutturano il sistema di welfare favorendo l'autonomia dei giovani, la simmetria di genere e la conciliazione tra lavoro e famiglia, consentono alla fecondità di non ridursi troppo, ai nuclei familiari di difendere il proprio benessere con un doppio stipendio (anche per quelli con titolo di studio basso) e quindi di contenere anche la povertà delle coppie con figli.

L'Italia stenta ad inserirsi in questo percorso. Come abbiamo illustrato nel paragrafo precedente, il nostro sistema di welfare rimane, in particolare, più a lungo centrato sulla figura del *male* breadwinner. Ad inizio degli anni '80 siamo ancora nelle fasi iniziali di questo cambiamento. La fecondità italiana è scesa sotto i due figli per donna, ma è ancora sui valori di Francia e Svezia che però rendono compatibili tali livelli con tassi di occupazione femminile più elevati (Fig. 2). Il fatto che il nostro Paese non riesca a cogliere le nuove opportunità di tale cambiamento lo si vede dal confronto con la situazione del 2000. Anziché rialzare i tassi di occupazione a parità di fecondità, l'Italia riduce la fecondità diventando uno degli stati occidentali con combinazione più bassa dei due indicatori, conseguenza soprattutto delle difficoltà di conciliazione.

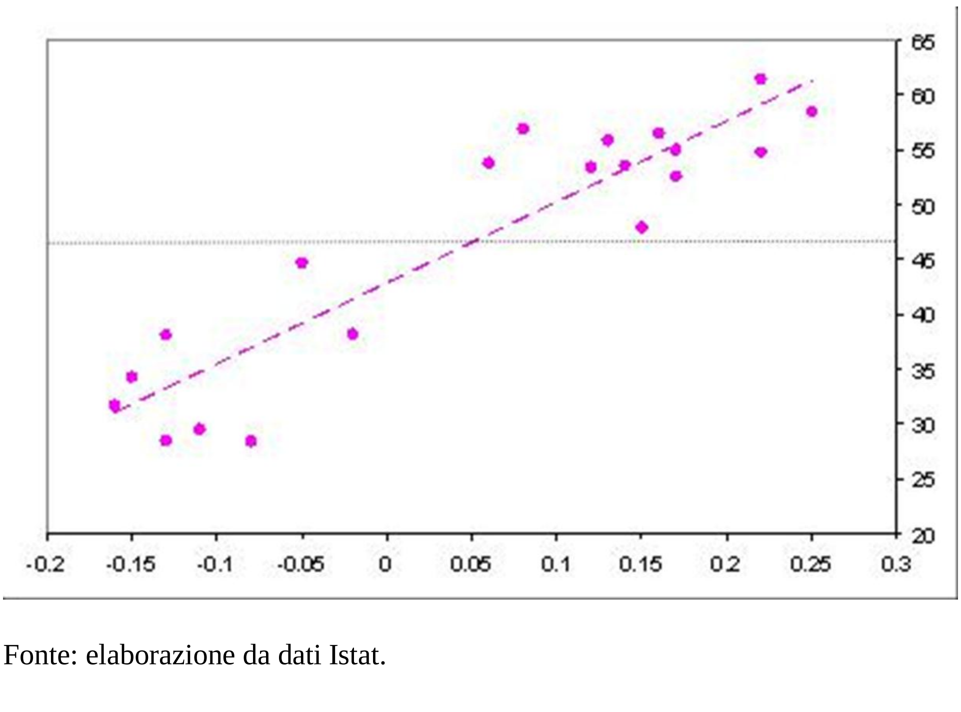
Così, invece di essere aiutate e incentivate con adeguate politiche a cogliere le opportunità superando il modello del *male* breadwinner, le famiglie si difendono dal cambiamento riducendo il numero dei figli. Rispetto agli altri paesi avanzati chi ha figli si trova infatti non solo con maggior difficoltà femminile a rimanere nel mercato del lavoro, ma anche con maggior rischio di povertà (Fig. 4).

Fig. 2 - Combinazione tra livelli di fecondità e di occupazione femminile. Anni 1980 e 2000.



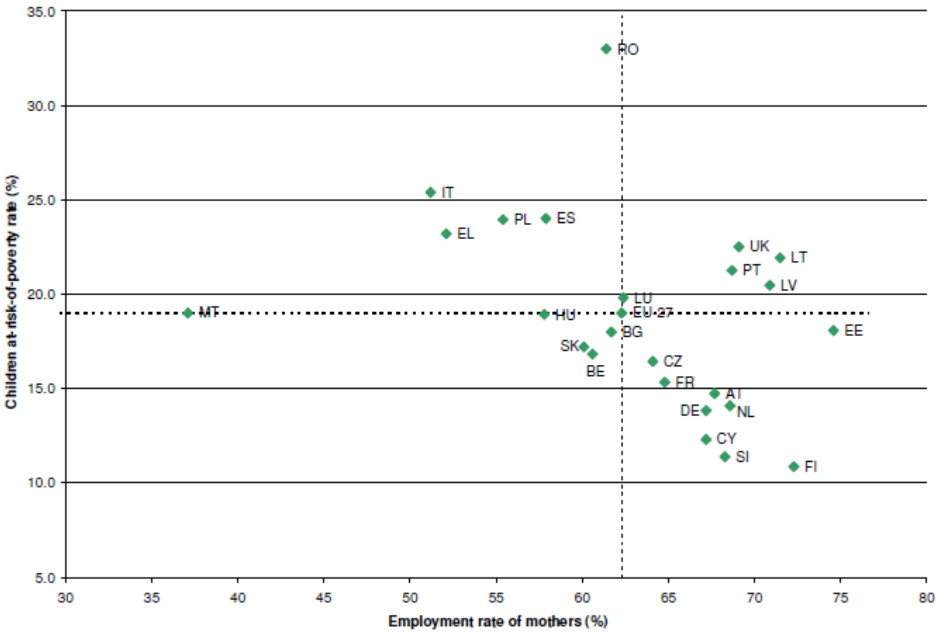
Fonte: dati Ocse.

Fig. 3 - Relazione tra livello di occupazione femminile e variazione di fecondità. Regioni italiane, periodo 1995-2006



Fonte: elaborazione da dati Istat.

Fig. 4 – Tassi di occupazione delle madri e povertà infantile



Fonte: EU-SILC 2007. Del Boca (2010).

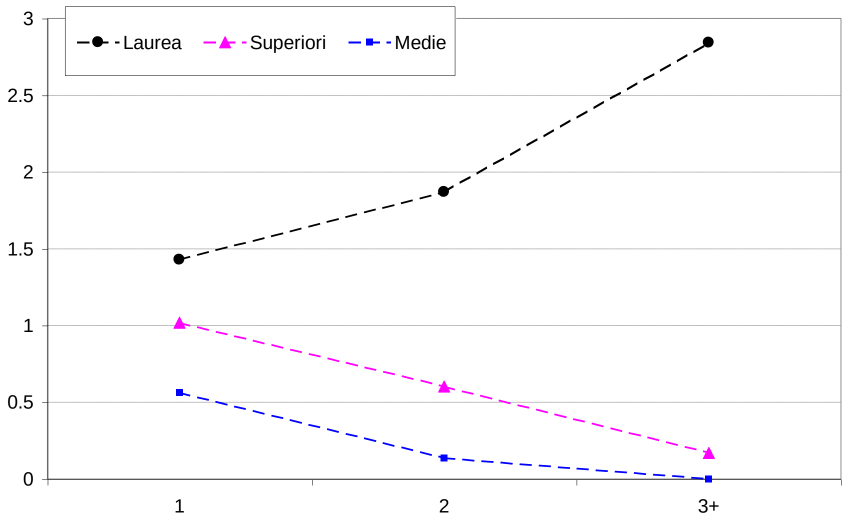
3.3. La chiave della conciliazione alla base di vecchie e nuove disuguaglianze territoriali e sociali

Una delle implicazioni della difficoltà di superamento del sempre più obsoleto modello di welfare tradizionale è il consolidarsi e inasprirsi di una polarizzazione sociale e territoriale. Nelle aree con minori servizi di conciliazione l'occupazione femminile stenta a decollare e la fecondità si riduce maggiormente. Emerge, infatti, progressivamente anche all'interno del territorio italiano una relazione macro positiva tra partecipazione femminile al mercato del lavoro e fecondità (Fig. 3). Dopo il minimo storico del 1995 la fecondità risulta aumentare, anche al netto delle nascite straniere, soprattutto nelle regioni dove occupazione delle donne e misure di conciliazione sono cresciute maggiormente. Dove invece, come nel Sud Italia, resiste il modello di *male* breadwinner, le donne trovano meno opportunità di valorizzazione del proprio capitale umano e maggiore è la caduta delle nascite. L'esito è una depressione sia sul versante economico che demografico (Rosina Viazzo 2007).

Ma oltre alla polarizzazione territoriale si è accentuata anche quella sociale. Non solo la fecondità si è ridotta maggiormente nelle aree meno sviluppate e con servizi pubblici meno presenti ed efficienti, ma anche per le categorie sociali meno in grado di compensare con proprie risorse culturali ed economiche tali carenze. E' proprio il titolo di studio femminile spesso a far la differenza consentendo di ridurre gli squilibri sia di genere che territoriali. Il divario tra occupazione maschile e femminile nelle età lavorative centrali (35-54), uno dei più elevati in Europa, passa da quasi 40 punti percentuali per chi ha titolo basso a meno di 10 per chi ha titolo alto (Pruna 2007).

Rosina e Saraceno (2008) hanno inoltre mostrato come da un lato le donne lavoratrici con qualifiche alte tendano a decidere più facilmente di non aver figli, ma sono anche, d'altro lato, proprio le donne in possesso di un titolo di studio elevato ad evidenziare una maggiore capacità di conciliare famiglia e figli con la continuità lavorativa (Fig. 5). Le laureate sembrano così essere pressoché le uniche a poter in qualche modo scegliere se rinunciare alla famiglia o conciliare i due ruoli. Il possedere una laurea si rivela essere infatti protettivo rispetto all'impatto dei figli sulla discontinuità lavorativa[2]. Rimane in ogni caso vero che il numero di figli è in generale maggiore per chi rimane fuori dal mercato del lavoro. Ciò significa anche che nascono più figli in famiglie non solo a reddito medio-basso, ma particolarmente vulnerabili alla perdita del lavoro da pare dell'unico occupato.

Fig. 5 - Coefficienti beta(*) ottenuti dall'analisi della probabilità di lavorare per il mercato a dieci anni dal primo impiego. Combinazione tra titolo di studio e numero di figli. Donne di età 40-59 in unione con figli.



(*) Stime nette ottenuto da modello di regressione logistica multipla. Categoria di riferimento: la combinazione "Medie" e "3+ figli".
Fonte. Rosina, Saraceno (2008).

Il titolo di studio compensa inoltre in modo rilevante lo squilibrio territoriale dell'occupazione femminile. Il confronto per età evidenzia un divario molto ampio tra Nord e Sud. Se però si confrontano solo le donne laureate lo svantaggio si riduce notevolmente, rimanendo comunque sensibile nelle età più giovani come conseguenza delle maggiori difficoltà meridionali di accesso al lavoro (Del Boca, Rosina 2009).

Fig. 6 - Tassi di occupazione per età distintamente per Nord e Sud Italia. Donne in generale e laureate. Anno 2007 (pre-crisi).

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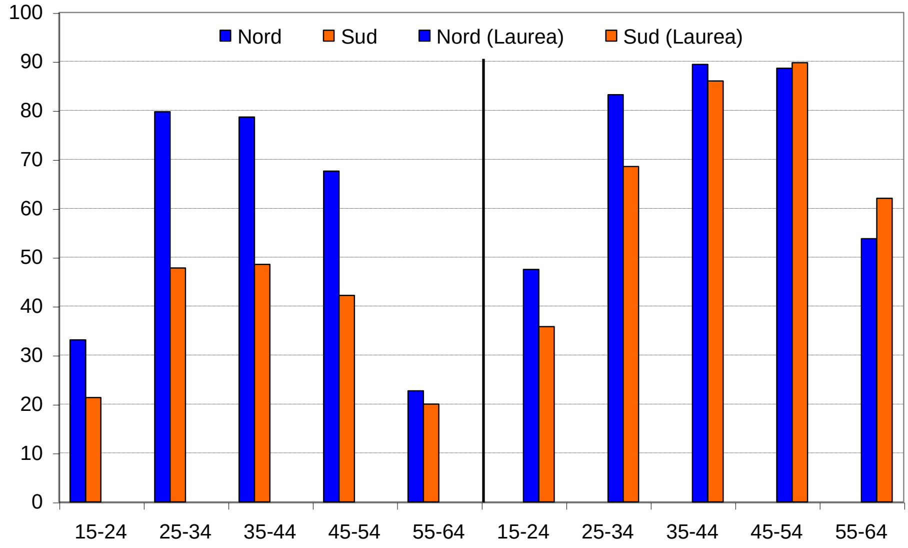
[2] Da una indagine Istat condotta nel periodo 2003-07 risulta che tra le donne che lavoravano e che hanno avuto un figlio, ben il 27% ha lasciato anche il lavoro e in oltre la maggioranza dei casi (57%) la causa dichiarata è la maternità stessa.



Fonte: Istat

4. Squilibri generazionali e ruolo condizionante delle risorse di partenza

Se l'Italia si contraddistingue per squilibri di genere e geografici più accentuati rispetto al resto dei paesi sviluppati, negli ultimi 30 anni si sono inaspriti anche quelli generazionali.
Paradossalmente oltre ad essere di meno dal punto di vista quantitativo, come conseguenza di decenni di bassa natalità, le nuove generazioni si trovano anche con maggiori difficoltà a trovare pieno accesso e valorizzazione nella società e nel mercato del lavoro. I tassi di partecipazione giovanile sono tra i più bassi in Europa e la differenza relativa con gli altri grandi paesi si è ampliata nel tempo **(Tab. 3)**. Il fatto che i giovani siano una risorsa scarsamente valorizzata trova riscontro anche nel divario remunerativo tra nuovi e vecchi lavoratori. Un valore oggi più ampio rispetto alla fine degli anni ottanta. In particolare le retribuzioni all'ingresso risultano relativamente più basse e non compensate da profili di carriera più rapidi (Brandolini 2008).
Oltre che con un minor investimento nella loro formazione e minori opportunità occupazionali, i giovani italiani si trovano, come abbiamo visto, anche con un sistema di welfare pubblico meno generoso verso di essi. Come è ben noto e ampiamente riconosciuto[3], la spesa per protezione sociale continua a essere fortemente sbilanciata verso le pensioni e in generale la protezione verso i rischi della vecchiaia (Onofri 2008). Viceversa, bassa è la quota destinata «alle politiche di sostegno al reddito nei casi di disoccupazione e per le politiche attive finalizzate alla formazione o per il reinserimento nel mercato del lavoro (Sabbadini 2008).

Tab. 1 - Giovani italiani che vivono con i genitori (%) per fasce d'età.

	Donne (1981)	Donne (1991)	Donne (2001)	Donne (2006)	Uomini (1981)	Uomini (1991)	Uomini (2001)	Uomini (2006)
20-24	55,2	72,1	79,8	84,9	79,8	84,8	89,6	91,6
25-29	19,8	34,8	46,8	49,4	39,9	53,2	66,3	68,5
30-34	8,7	14,0	19,2	20,8	15,5	23,7	33,2	41,1

Fonte: Censimenti; Indagini Multiscopo Istat, anni vari.

[3] Si veda, ad esempio, quanto riportato nello stesso «Libro verde» del ministero del Lavoro, della salute e delle politiche sociali, *La vita buona nella società attiva*, 2008.

Negli anni Settanta c'era un'ampia omogeneità tra i paesi occidentali nei tempi di conquista dell'autonomia dalla famiglia di origine. Le grandi trasformazioni della modernità sembravano aver quasi annullato storiche differenze tra i vari paesi sui tempi del processo di entrata nella vita adulta. I giovani lasciavano la casa paterna relativamente presto. Anche in Italia solo una minoranza viveva ancora con i genitori dopo i 25 anni. Nell'ultimo trentennio i giovani nord-europei hanno continuato a lasciare la famiglia presto - aiutati da adeguate politiche pubbliche di promozione dell'autonomia - mentre nel Sud Europa è iniziata una fase di progressivo prolungamento dei tempi di uscita (Tab. 1). Alla base di queste differenze vi sono senza dubbio fattori culturali, come i più forti legami intergenerazionali rispetto ai Paesi del Nord (Dalla Zuanna, Micheli 2003), ma ad essi si sono aggiunte crescenti difficoltà economiche (Rosina, Micheli, Mazzuco 2007). Secondo i dati Istat la quota di giovani in età 20-34 che indicano come motivo di permanenza nella famiglia di origine le difficoltà ad avere i mezzi per mantenersi è cresciuta dal 2003 al 2008 dal 40 al 46,5%, mentre chi dice che sta bene così si è ridotto dal 42% al 32,5%[4].

Coerente con la crescente importanza dei fattori strutturali nello spiegare la ridotta autonomia delle nuove generazioni è il sorpasso del Sud rispetto al Nord. E' soprattutto nelle regioni del Mezzogiorno, infatti, che disoccupazione e sottoccupazione costituiscono i motivi principali della permanenza nella casa dei genitori ben oltre la soglia dei trent'anni. Per tutto il XX secolo a rimanere più a lungo a vivere con i genitori sono stati i giovani delle regioni centro-settentrionali e sui motivi di permanenza dominavano i fattori culturali (Barbagli, Castiglioni, Dalla Zuanna 2003). Negli ultimi quindici anni è invece cresciuto sensibilmente il peso delle difficoltà legate alla carenza di un lavoro stabile e soprattutto di un reddito adeguato e continuativo per riuscire a mantenersi. Fattori, questi, più accentuati nel meridione. La geografia del fenomeno è così mutata e si sovrappone ora sempre più a quella della bassa occupazione (Tab. 2).

Tab. 2 - Permanenza nella famiglia di origine (18-34 anni) e tasso occupazione (15-24 anni).

	1993-94	2006	2006 su 1993	Tasso occup. 15-24
Nord-Ovest	56	57	101.8	32.5
Nord-Est	57.6	58.5	101.6	35.2
Centro	57.1	60.4	105.8	26.1
Mezzogiorno	55.5	62.5	112.6	17.9

Fonte: Istat

Tab. 3 - Tassi di occupazione 15-24 anni.

	1996	2006
Italia	*27.6*	*25.8*
Francia	25.8	28.8
Germania	45.5	42.6
Regno U.	55	52.2
Spagna	23.6	39.4
Ue15	36.7	39.7

Fonte: Eurostat

Il quadro che emerge, nel complesso, è quello di un aumento della provvisorietà delle condizioni di vita fin oltre i 30 anni e una caduta di giovani pienamente e solidamente attivi nel mercato del lavoro e impegnati nella costruzione di un progetto familiare.

[4] Il complemento a 100 sono i giovani che ancora studiano.

I dati Eurobarometer ci dicono che nella fascia d'età 16-30 quasi la metà dei giovani italiani dipende economicamente dei genitori, contro circa un terzo nel resto d'Europa. Secondo i dati Istat tra i 18 e i 39 anni vivevano ancora con i genitori a fine 2003, 8 milioni e 300 mila persone (48%). A 3 anni di distanza (inizio 2007) solo uno su cinque è riuscito a lasciare la famiglia di origine. Tra chi aveva detto che con certezza sarebbe uscito, solo il 53% è riuscito a farlo. Una analisi più approfondita su tali dati (Rosina, Ferrai, Sironi 2011) evidenzia come a rivedere al ribasso le scelte di autonomia siano, a parità di condizioni, i giovani con meno risorse socio-culturali di partenza.
Va anche sottolineato come un modello i welfare, come quello italiano, che affida quasi esclusivamente alla famiglia di origine i compiti di aiuto ai giovani in difficoltà si riveli essere fortemente iniquo. Sono, infatti, svantaggiati i giovani che provengono da famiglie con status socio-culturale più basso e minori risorse economiche (Sgritta 2002; Livi Bacci 2005).
Un recente studio dell'OCSE (2010) evidenzia, ad esempio, come l'Italia sia uno dei paesi in Europa con legame più forte tra salario dei genitori e quello dei figli. In particolare avere un padre laureato permette al figlio di guadagnare in media il 50% in più rispetto a chi ha titolo più basso. Un dato, tra gli altri, che ben evidenzia come nel contesto italiano più che il titolo di studio dei giovani stessi, particolarmente protettivo rispetto ai rischi e propulsivo rispetto al successo sociale risulti quello dei genitori ed in particolare le risorse della famiglia di origine, in grado di compensare le carenze di opportunità e di welfare pubblico.

Conclusioni

Gli elementi propri del funzionamento del sistema di welfare italiano, che per lungo tempo sono stati i suoi punti di forza, si stanno oggi trasformando in elementi di estrema debolezza, mettendo in crisi le capacità di tenuta della famiglia nel lungo periodo e con effetti negativi sia sulla coesione sociale che sullo sviluppo.
Oggi il welfare italiano e in particolare le politiche a favore delle famiglia si rivelano – dato anche lo scenario di forti mutamenti demografici e lavorativi femminili – profondamente carenti, inadeguati nello sostenere scelte virtuose per la crescita e il benessere. Basti pensare alle scelte procreative delle giovani coppie, alla lotta alla povertà minorile, alle condizioni dei giovani nel percorso di transizione alla vita adulta, alle pari opportunità tra uomini e donne e tra bambini provenienti da classi sociali e background culturali diversi.
Nel welfare state italiano è prevalso un orientamento che è stato definito "familistico", intendendo con ciò un orientamento poco incline ad un intervento del pubblico sui compiti di cura familiari e come sostegno alle scelte riproduttive. Oggi questo "familismo" dei Paesi dell'area mediterranea si è trasformato in una minaccia per la fecondità, a livelli persistentemente bassi, e per la formazione di nuove unioni, che si realizzano in età sempre più tardiva, ma anche nel dinamismo e nell'intraprendenza dei giovani. In ultima analisi deprime la crescita e mette in crisi il funzionamento del sistema di welfare state, che si regge proprio su un contratto "intergenerazionale" sostenibile ed equo, oltre che di genere.

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“Making Italy: Statistical Knowledge and the Risorgimento”

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In recent years the historiography of Italian statistics has greatly increased our understanding of the relationship between statistics and statisticians and fascism and of the various troubling continuities that characterized the period after the collapse of the regime, along with some discontinuities. Some scholars such as Francesco Cassata have pointed out the existence of a certain “affinity” between statistics and authoritarian regimes such as fascism: as a discipline in the service of planning by the state statistics would display an organic linkage with the regime. The emphasis on affinity, however, contrasts dramatically with the perceptions that the liberal supporters of statistics during the Risorgimento had of the discipline and the practice of statistics when they went so far as to claim that it was the “discipline of democracy.” The idea may strike us as being rather peculiar, if not naive. Of course, we have the benefits of hindsight, having seen the way in which statistics coexisted quite well in the twentieth century in connection with authoritarian and totalitarian states. But one could argue that the nineteenth-century statisticians should have been warned since they were operating in the context of absolute states that were interested in and benefited from the collection of numerical information. So, where did their enthusiasm come from?

By drawing on my previous work, in my talk I want to elaborate on the reasons why nineteenth-century liberal statisticians, and specifically the Risorgimento ones, had such a positive view of -and placed such great hopes in- the the knowledge offered by statistics, and will then reflect on some of the problems that these hopes may have generated as the political and intellectual context changed in later years.

During the Risorgimento, statistics came to represent a science with an inherently civilizing function, a type of knowledge that would improve society and the state. The “facts” of statistics were supposed to provide a “positive,” namely experiential, knowledge to enlighten state administrators, but also the productive classes and the liberal professions, and possibly even the lower strata. Beside enlightening the public, the writing of statistical descriptions was a means to construct the authority and to legitimate the claims to power, or at least to a larger role in the conduct of public affairs, of the liberal segments of the Italian educated classes. The making of these "inventories" conveyed the ability of their authors to grasp the realities of state and society. These realities were characterized in terms of resources and institutions to be known, managed and increased, in other works to be brought under the eye of the "public" and rationalized. The knowledge thus produced was to shape an enlightened public opinion and to lead to a rational making of political and administrative decisions. It was to teach present and prospective administrators and statesmen about their tasks, about methods of observation, about the indicators of modernity, so that they could help deliver a modern society through the application of wise policies based on positive knowledge.

While expressing the aspiration to a greater public role for their makers, this kind of works helped to construct the very objects on which the action of liberal reformers was to apply. The construction of the nation was of course a main component of the liberal project. Among other things, statistics was fundamental in constructing the idea of a national population. The population constructed by statistics was not the same as the people imagined by Mazzini and the national-patriots of a democratic bent, but the two notions certainly dovetailed. For the statisticians the population was a primary resource of a state and the main item in those inventories of the resources of a nation that constituted statistical descriptions in the nineteenth century.

Moreover, nineteenth-century statisticians contributed to the elaboration of a cultural and ethnic idea of the Italian nation. In the publications of patriotic statistics of the 1850s, for example, views about what constituted a nation included not only language, but also race - although this was a more contested notion. One of the participants in the debate on what was a nation in the 1850s and 1860s, the Piedmontese linguist, Giovenale Vegezzi Ruscalla, already deployed the vocabulary and the classification of the "science" of race, even though he believed that language was the distinctive and most solid (we would say "objective") feature of nations.[i]

The supporters of the national cause were very aware of the constitutive or constructive function of statistics. Since the 1830s statistics of Italy as a whole were published and deployed in a national public sphere which was eager for this kind of recognition of the existence of the nation and some called this type of statistics "patriotic statistics", an "aggressive arithmetic" that made Italy "scientifically".[ii] After 1848, in the context of the new phase in the struggle for independence which would bring to the eventual unification of Italy under Piedmontese hegemony, two Milanese patriots with positivistic inclinations transformed statistical publications into an instrument of direct propaganda on behalf of the national cause: these were Pietro Maestri (1815-1871) and Cesare Correnti (1818-1888), who, while in exile in Turin, published statistical yearbooks where the figures of all the Italian states were added together to evoke the "body" of the new nation and to demonstrate its viability.[iii]

The Annali universali di statistica, a periodical which had supported the spread of all forms of useful knowledge since the 1820s, hailed these works with words of great praise, reproaching the regimes in power of keeping statistics in a deplorable state, thus denying Italians the knowledge of their condition, indeed the "knowledge of themselves." The only state in Italy where statistics thrived, it was claimed, was Piedmont since this was the only state endowed with representative institutions.

After 1861, these same men took charge of the development of official statistics in the new Kingdom: in 1862 Pietro Maestri was appointed director of the Divisione di statistica generale, the central directorate of statistics located in the Ministry of Agriculture, Industry and Commerce. Correnti, then a representative of the Historic Right in the lower house (but with sympathies for the Historic Left which he joined in 1876), became a member of the official advisory committee on statistics. These two men in particular brought the legacy of the preunification tradition of statistics to bear on the institutions of the new state in the 1860s. There was a direct "filiation" at work here since Correnti had been a collaborator of the Annali universali di statistica where the teaching of one of the main theorists of administrative statistics of the 1820s and 1830s, Gian Domenico Romagnosi and Melchiorre Gioia, had been particularly influential.[iv] Although not part of that circle (his politics had always been more democratic), Maestri had also absorbed the tenets of that specific culture of observation.

In 1864 in one of the official publications devised to popularize statistics and to make the new Italy known to "herself," Cesare Correnti and Pietro Maestri observed that statistics were a part of the "spontaneous life" of society. All associations were in need of statistical knowledge, especially the institutions of previdenza, such as mutual-aid societies and savings banks, which made up a "new form of social charity." Statistical information could even help rationalize the market economy:

> ... free competition accused not always unjustly of being the cause of the disorders of production, cannot free itself from these accusations and avoid the dangers that it produces unless it increases the light of publicity, unless it multiplies information, and unless it impedes, through the help of industrial and commercial statistics, the confusion produced by the improvident crowding of consumers and producers [on the market].[v]

The authors especially made a point of stressing how the "science" of statistics was a specifically liberal institution, a "social" and not merely an "administrative" institution. It was no longer a knowledge subjected to the arbitrary nature of governments and in the hands of servile administrators, but a "means of impartial and scientific evaluation," in fact it was the "the discipline of democracy [...], the reflexive and experimental consciousness of humankind."[vi] Liberty and the institution of publicity now insured that collection of "sincere and complete" statistics which had allegedly never occurred under "despotic" governments.

Trustworthy collections of statistics were the fundamental source for the knowledge of "social facts" and especially of their "laws," which served to provide guidelines for legislators. This reference to the laws of society which statistics was supposed to reveal marked the reception of a conceptualization which went beyond the classificatory and descriptive tasks assigned to the science of statistics in previous decades. This different conceptualization of statistics was linked to the name of Adolphe Quetelet who since the 1830s had elaborated his views in works which, although known to the Italians, had not had much impact on their practices.

But it was a conceptualization which the Italians combined easily with the idea of statistics as a "science of government" which had characterized the descriptive tradition everywhere in Europe. For Maestri and Correnti the knowledge of social laws provided by statistical science was not at all in antithesis to state intervention; in fact it served to rationalize it by placing both legislators and public opinion ("the public conscience of each state")[vii] in the condition to express sound judgment and make rational decisions. Without such knowledge, chance and passions dominated. In contrast, the enlightening of politicians and public opinion through statistical knowledge would contribute to the rationalization of politics: when political divergences would submit to the rule of reason, disagreements among parties and even conflicts among nations would be settled peacefully and prosperity for all would ensue. Thus Correnti and Maestri expressed their ultimate wish:

> From today on political parties will fight each other more through reason than through arms, since to the authority of number, which prevails during elections, will be added the incontrovertible evidence of demonstrations based on the observation of social dynamics, increasingly favored by the progress of statistics. In the same way, when a philosophical and spiritual statistics will be added to numerical and geometric statistics, tensions among peoples could also be solved by the intervention of scientific forecast and measuring; at the same time the need and temptation to resort to physical force will diminish as the it will be possible to predict the outcome of a conflict among nations whose strength is known and measured.[viii]

The high hopes that find expression in these words were part of the more general intellectual and political climate of the mid-nineteenth century. In the age of free trade, when many still believed that humankind was moving towards a future of never-ending progress, statisticians across Europe cultivated the idea that statistics could become a kind of international, "universal language," a medium of communication that could favor commerce and promote understanding among nations. Since the early 1850s an important instrument in the creation of this communicative system had been the International Congresses of Statistics held in several European capitals. An institution that well epitomizes the faith in progress and international collaboration of the mid-nineteenth-century European elites, the congresses brought together official and "free" statisticians, government representatives and men, or gentlemen, of science. The Minister of the Interior of Belgium who greeted the participants to the first congress in Brussels stressed the importance of statistics in "strengthening even more the links between nations, and to fortify everywhere the sentiment of brotherhood and peace which today protect humanity against the resurgence of crazy national rivalries."[ix]

The optimism shared by scientists and politicians alike in the possibility of a knowledge transcending political differences as a basis for policy was a function of their positivistic belief that facts could speak for themselves, and of the equally widespread assumption about the fundamentally rational nature of human beings, at least of educated ones. In the Italian context, in particular the new state elites cultivated the hope that, thanks to its uninhibited development under the auspices of representative institutions, statistics could be fully applied to help legislators find "scientific" solutions to the numerous thorny issues that they had to face: for example with respect to the problem of "determining the administrative and civil topography" of the country (namely the issue of the administrative partition of the new state) which, in the view of the statisticians, "politics [had] beclouded."[x] As we know, it was the work of the state statisticians that gave solidity to the division of the country by compartimenti, the units of official statistical reporting that would become the regions recognized in the Constitution of the Italian Republic in 1948.

This reference to the confusion generated by political confrontation probably expressed a certain frustration at the high degree of conflict and division that characterized political debate in the newly established nation. Although neither Maestri nor Correnti were technocrats who intended to exile politics from decision making, this reference hinted at the presence of an extra-political component in their very conception of liberal politics, namely of a faith in science as a problem-solving device and a source of legitimation. When they used the expression "discipline of democracy" to refer to statistics, they seemed to have in mind as much the thriving of scientific knowledge under a liberal government as the thriving of a liberal government under the dominion of scientific knowledge. Indeed, Maestri and Correnti substantiated their claim not by stressing the possibility offered by public statistics to scrutinize politicians' deeds, but by insisting on how representative government allowed for the collection of more and better statistics leading –one would assume- to a less conflicted political landscape.

The ideas of the statisticians diffused in the numerous official publications of the time (distributed freely to the various state and local administrations) encountered a certain favor among the "public": witness, for example, the large participation registered at the International Congress of Statistics held in Florence in 1867. With about 750 members, almost 90 percent Italian, this was the largest meeting of its kind. It drew participants from a great number of state agencies, central and peripheral state administrations, municipalities, provincial committees for the collection of statistics, learned societies, chambers of commerce, secondary schools, universities, academies; inspectors of prisons, directors of hospitals, lawyers, in other words, the whole "bourgeois" universe that statisticians had been addressing all along went to the congress en masse. They were all men, as it should be expected, who came mostly from the only places where that "impersonal reason," as Correnti called public opinion, was formed, namely from cities and towns.[xi]

But if statistics became truly popular in those sectors of the bourgeoisie more closely linked to the state and in the liberal professions, in contrast the projects of the state statisticians were not popular at all in other bourgeois segments, the commercial and industrial classes. Along with the landowning elites, these feared any kind of inquisitiveness on the part of the state, even a state that was certainly on their side. When Maestri tried to quantify the economic activities of the nation he encountered difficulties that he had never imagined, and that resulted in the failure of the statistics of "manufacturing industry" launched in 1862[xii] and in the virtual absence of any reliable data on the quantities of agricultural production until a new cadaster was made many years after unification.

State statisticians were more successful in monitoring the movements of the national population as a biological species; demographic statistics could rely on a frame of routine practices of administration which had been in place for a fairly long time. They were at their most successful finally in photographing the institutions of modernity, or their lack: schools, savings banks, charities, mutualist associations, elections, and so on. These were the objects populating the official publications of Italian statistics.

State statisticians of the Risorgimento generation were taken aback by the difficulty they encountered in implementing their projects in the context of a liberal regime. In the disillusioned climate of the 1870s, they tended to read it as yet another sign of the backwardness of Italian society. In the mid-1870s official publications began to denounce the skepticism about statistics that was widespread among the Italian people. In the first two issues of the Archivio di statistica, a journal founded in 1876 and devoted to promoting statistical research and debate, Correnti lamented the little collaboration that statisticians found in the slow ranks of central and local administrations and in the public at large.[xiii] Also in the pages of this journal, the following year Aristide Gabelli linked this skepticism to the lack of "civil sentiment," to the absence of trust in the government that permeated Italian society, and to the weight of a tradition of a mostly literary and bookish culture.[xiv]

What Correnti and Gabelli cast in terms of an Italian peculiarity -- the lack of collaboration on the part of the population in the making of the country's statistics – was, however, a problem that bothered statisticians elsewhere, even in that most statistically advanced of all statistical states, namely England. At the jubilee conference organized by the Royal Statistical Society of London in 1885, for example, several speakers complained about people not understanding the "value of statistics" and about "those who regard the work of the statistician as inquisitorial in its character, and 'preferring darkness than light,' would rather incur the penalties attached to non-compliance with State ordinances on this behalf, than furnish facts which they regard as exclusively their own property."[xv]

In fact Italian statisticians learned at an early date that no matter the degree of "civilization" of a society, much of the information that they wanted the public to know was to be negotiated with the public itself, especially when this was formed by the social elites -- a far cry from that view of an all-encompassing statistical gaze that had been the legacy of the Benthamite Gioia, but certainly more reflective of the actual destiny which fell on statistics in liberal Italy. Needless to say, what we could call the liberal statistical project of rationalization of politics cultivated by the state statisticians in the 1860s had no much impact on the political reality of liberal Italy. On the other hand, statistics became then a regular feature of the liberal state, a stable component of its administrative apparatus although subject to the vicissitudes that the historiography has abundantly illustrated. It also contributed to the shaping of the idea of the Italian population as a bio-political entity which other measurers in the following years would dissect in ways that instead of strengthening unity emphasized the internal differences of the nation. Ironically, the patriotic enterprise of statistics turned out to be used to stress the very internal divisions that the new nation-state was supposed to mend.

This is another story that we have no time to expand on now. It is now the time to move to some conclusions. We have seen that in the eyes of the liberal practitioners and supporters of statistics who were operating in the old Italian states, the collection of quantitative information about state and society and its free circulation among the public were an indispensable step towards a more transparent working of power. In contrast to the secrecy of the absolutist regimes, the type of state the liberal patriots aimed to establish would be open to the scrutiny of its members and would be based on (while also contributing to) the existence of an enlightened public sphere.

But there was more. The promoters of statistics of the Risorgimento generation also seemed to share a kind of utopian view of statistical investigations as providing a type of knowledge that would insure the harmonious functioning of the different institutions and forces making up a free society. Their "trust in numbers," to use the expression coined by Theodore M. Porter,[xvi] was vast, as we would expect. Even though it did not translate in a technocratic vision, it exhibited some exaggerated expectations towards the possibilities of a science of government, perhaps inevitable given the mainly theoretical understanding that nineteenth-century liberals had of the working of representative government.

To conclude, we may take a moment to reflect on the ramifications of the utopian view of statistical investigations shared by Risorgimento statisticians. Its utopianism consisted in the belief that it could produce a type of knowledge that would lead to the overcoming of political conflict by insuring a rational decision-making process and the harmonizing of the different forces making up a free society. It would be wrong to describe those who carried this view in the nineteenth century as technocrats, but undoubtedly one could see here the roots of a technocratic vision for the government of society and understand how in later years, as social and political conflict also grew exponentially in the nation, the push towards the integration of science into government with an anti-democratic function grew dramatically. At that point it may not be surprising to see many nationalist statisticians, economists, and sociologists cultivate the dangerous dream of addressing social problems through the intervention of science, in fact through its incorporation into the working of government, of a government, however, no longer subjected to the messy politics of parliamentary representation and to the will of the (much distrusted) majority.

Notes

[i] See Giovenale Vegezzi Ruscalla, "Abbozzo etnografico d'Europa," in Annuario statistico italiano Anno I 1857-58 [ed. by C. Correnti], Turin-Milan, 1858,

pp….

[ii] The quotations are from E. Monnier, “Le popolazioni italiane: nuovi studi statistici,” Annali universali di statistica, 4th s., 37 (1869), p. 243.

iii. The most important of these works is the Annuario statistico italiano Anno I 1857-58.

iv. At the end of the 1860s also another statistician and political economist very influenced by the thought of Romagnosi, Angelo Messedaglia, would join Correnti and others in this committee.

v. Annuario statistico italiano. Anno II. 1864 (Turin, 1864), p. xviii.

vi. Ibid., p. xiii.

vii. Annuario statistico italiano Anno II, p. xxxv.

viii. Ibid., p. xxxv.

ix. Compte rendu des travaux du congrès général de statistique réuni à Bruxelles les 19, 20, 21, et 22 septembre, 1853 (Brussels, 1853), p. 19.

x. Annuario statistico italiano. Anno II, p. 47.

xi. The proceedings and statistics of the congress are in Compte-rendu des travaux de la VIe session du Congrès International de Statistique réuni à Florence les 29, 30 septembre, 1, 2, 3, 4 et 5 octobre 1867 (Florence, 1868). Correnti's expression is on page 116.

xii. On the failure of this investigation see also A. Polsi, "La 'statistica dell' industria manifattrice' del 1862," Quaderni storici 15 (1980), pp.894-917.

xiii. Archivio di statistica 1 (1876).

xiv. "Gli scettici della statistica," Archivio di statistica 2 (1877), pp. 20-21.

xv. Jubilee Volume of the Statistical Society, June 22-24, 1885 (London, 1885), p. 151 (intervention of the economist Leone Levi).

[xvi] T. Porter, Trust in Numbers. The Pursuit of Objectivity in Science and Public Life, Princeton, 1995.

The Permutation Testing Approach in the Light of Conditionality and Sufficiency Principles

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1 Abstract and Introduction

In recent years permutation testing methods have increased both in number of applications and in solving complex multivariate problems. A large number of testing problems may also be effectively solved using traditional parametric or rank-based nonparametric (NP) methods, although in relatively mild conditions their permutation counterparts are asymptotically as good as the best ones [2]. When available permutation tests (PT) are essentially of an exact NP nature in a conditional context, where the conditioning is on the pooled observed data which are always a set of sufficient statistics in the null hypothesis. On the one hand, the application of the conditionality principle (CP) of inference provides the PT approach with important and useful properties. On the other, the reference null distribution of most parametric tests, with the exception of some quite simple situations, is only known asymptotically. Thus, for most sample sizes of practical interest, the possible lack of efficiency of PT may be compensated by the lack of approximation of parametric counterparts. There are many complex multivariate problems (quite common in biostatistics, clinical trials, engineering, epidemiology, experimental data, industrial statistics, pharmacology, psychology, social sciences, etc.) which are difficult, if not impossible, to solve outside the CP framework and in particular outside the method of nonparametric combination (NPC) of dependent PT [5]. Frequently parametric methods reflect a modelling approach and generally require the introduction of a set of quite stringent assumptions, which are often difficult to justify. Sometimes these assumptions are merely set on an *ad hoc* basis. For instance, too often and without any justification researchers assume multivariate normality, random sampling from a target population, homoscedasticity of responses also in the alternative, random effects independent of units, etc. In this way consequent inferences have no real credibility. Indeed, often their use appear to be mostly related to availability of methods than with well discussed requirements derived from a rational analysis of reality. On the contrary, NP approaches try to keep assumptions at a lower workable level, avoiding those which are difficult to justify. Thus, they are based on more realistic foundations, are intrinsically robust and consequent inferences credible. For instance PT comparisons of means or of other suitable functionals do not require homoscedasticity of the data in the alternative, provided that random effects are either non-negative or non-positive.

However, our point of view is that any statistician should have in his tool-kit of methods both the parametric, including the Bayesian, and the NP because in his life he surely meets with problems which are difficult, if not impossible, within one approach and others which in turn are difficult, if not impossible, within the other approach. For some examples of both such situations as well as for the literature on the subject matter we refer to the book [5] and references therein.

In this presentation we discuss main properties of PT derived by direct application of sufficiency principle (SP) and the CP. The outline includes: a discussion of data model which extends that used by standard parametrics; a presentation of SP and CPs and their involvment in the permutation testing principle; notation, definitions, and main properties (exactness, similarity, uniform unbiasedness, consistency) of PT; the notion of permutation empirical likelihood (PEL) induced by a test statistic; a suggestion for a Bayesian permutation approach; and the extension of conditional.to unconditional inference.

2 The Data Model

As a guide and without loss of generality we refer to the two-sample one-dimensional design. Extensions to one-sample and multi-sample designs are straightforward. The analysis for multivariate designs requires the NPC. Let us assume that a non-degenerate variable X takes values on sample space $\mathcal{X}$, and that associated with $(X, \mathcal{X})$ there are parent distributions P belonging to a NP family $\mathcal{P}$ of distributions. We recall that "*a family $\mathcal{P}$ of distributions is NP when it is not possible to find a finite-dimensional space* Θ (the parameter space) *such that there is a one-to-one relationship between* Θ *and* $\mathcal{P}$, *in the sense that each member P of $\mathcal{P}$ cannot be identified by only one member θ of* Θ, *and vice versa*." In practice parametric families only contain distributions defined by a well-specified finite set of parameters; whereas distributions whose parameters are unspecified or are infinitely many are NP. Each $P \in \mathcal{P}$ gives the probability measure to events A belonging to a suitable collection (an algebra) $\mathcal{A}$ of events. Family $\mathcal{P}$ may consist of distributions of either real (continuous, discrete, mixed) or categorical (nominal or ordered) type of variables. It is assumed that each family $\mathcal{P}$ admits the existence of a dominating measure $\xi_{\mathcal{P}}$ in which respect the density $f_P(X) = \mathrm{d}P(X)/\mathrm{d}\xi_{\mathcal{P}}$ is defined.

The density on every observed sample point $X \in \mathcal{X}$ is assumed to satisfy the condition $f_P(X) > 0$ (in what follows we do not distinguish between a variable X and its observed sample points, the context suffices to avoid misunderstandings).

Let $\mathbf{X}_j = \{X_{ji},\ i = 1, \ldots, n_j\} \in \mathcal{X}^{n_j}$ be the independent and identically distributed (IID) sample data of size n_j coming from $P_j \in \mathcal{P}$, $j = 1, 2$. A notation for data sets with independent samples is $\mathbf{X} = \{X_{11}, \ldots, X_{1n_1}, X_{21}, \ldots, X_{2n_2}\} \in \mathcal{X}^n$, whose related model, with clear meaning of the symbols, is $(\mathbf{X}, \mathcal{X}^n, \mathcal{A}^{(n)}, P^{(n)} \in \mathcal{P}^{(n)})$, where $n = n_1 + n_2$, and $P^{(n)} = P_1^{n_1} \cdot P_2^{n_2}$. To denote data sets in the permutation context it is sometimes convenient to use the unit-by-unit representation: $\mathbf{X} = \mathbf{X}^{(n)} = \{X(i),\ i = 1, \ldots, n;\ n_1, n_2\}$, where it is intended that first n_1 data in the list belong to first sample and the rest to the second. In practice, denoting by $\Pi(\mathbf{u})$ the set of permutations of unit labels $\mathbf{u} = (1, \dots, n)$ and by $\mathbf{u}^* = (u_1^*, \dots, u_n^*) \in \Pi(\mathbf{u})$ one of these permutations, $\mathbf{X}^* = \{X^*(i) = X(u_i^*),\ i = 1, \dots, n;\ n_1, n_2\}$ is the related permutation of $\mathbf{X}$, so that $\mathbf{X}_1^* = \{X_{1i}^* = X(u_i^*),\ i = 1, \dots, n_1\}$ and $\mathbf{X}_2^* = \{X_{2i}^* = X(u_i^*),\ i = n_1 + 1, \dots, n\}$ are the two permuted samples, respectively. Of course, in multivariate problems data vectors associated with units are then permuted. The pooled data set is also denoted by $\mathbf{X} = \mathbf{X}_1 \biguplus \mathbf{X}_2 \in \mathcal{X}^n$, where $\biguplus$ is the symbol for pooling two data files.

We discuss testing problems for stochastic dominance alternatives (one-sided) as are generated by treatments with non-negative random shift effects Δ. In particular, the alternative assumes that treatments produce effects Δ_1 and Δ_2, respectively, and that $\Delta_1 \overset{d}{>} \Delta_2$, where $\overset{d}{>}$ stands for stochastic (or distributional) dominance. Thus, the hypotheses are $H_0 : X_1 \overset{d}{=} X_2 \overset{d}{=} X \equiv P_1 = P_2$, and $H_1 : (X_1 + \Delta_1) \overset{d}{>} (X_2 + \Delta_2)$, respectively. Extensions to non-positive and two-sided alternatives are straightforward. Note that under H_0 data of two samples are exchangeable, in accordance with the notion that units are randomized to treatments. Without loss of generality, we assume that effects in H_1 are such that $\Delta_1 = \Delta \overset{d}{>} 0$ and $\Pr\{\Delta_2 = 0\} = 1$. The latter condition agrees with the notion that an *active treatment* is only assigned to units of first sample and a *placebo* to those of the second. Moreover, we may let Δ to depend on units and on related null responses, so that pairs (X_{1i}, Δ_i), $i = 1, \dots, n_1$, satisfy the relation $(X_{1i} + \Delta_i) \geq X_{1i}$ with at least one strict inequality. In this situation the induced stochastic dominance $(X_1 + \Delta) \overset{d}{>} X_2 = X$ is compatible with non-homoscedasticities in the alternative. Thus, the null hypothesis can also be written as $H_0 : \Delta \overset{d}{=} 0$. Other than measurability, no further distributional assumption on random effects Δ is required. It is required that error deviates X and test statistics $T : \mathcal{X}^n \to \mathcal{R}^1$ are measurable in H_0. To emphasize the roles of sample sizes and effects, we may use the notation $\mathbf{X}^{(n)}(\Delta) = \{X_{11} + \Delta_1, \dots, X_{1n_1} + \Delta_{n_1},\ X_{21}, \dots, X_{2n_2}\}$ to denote data sets; and so $\mathbf{X}^{(n)}(0)$ denotes data in H_0. It is worth noting that the pooled data $\mathbf{X}^{(n)}(0)$ is always a set of sufficient statistics for P in H_0. Indeed, since $f_P^{(n)}(\mathbf{X})/f_P^{(n)}(\mathbf{X}) = 1$, the conditional distribution of $\mathbf{X}$ given $\mathbf{X}$ is independent of P. Furthermore, when P is NP or the number of its parameters is larger than sample size or in most cases in which it is outside the regular exponential family, $\mathbf{X}$ is *minimal sufficient*.

PT lie within the conditional method of inference, where the conditioning is on the observed data set $\mathbf{X}$. The related conditional reference space is denoted by $\mathcal{X}^n_{/\mathbf{X}}$. Essentially $\mathcal{X}^n_{/\mathbf{X}}$ is the set of points of sample space $\mathcal{X}^n$ which are equivalent to $\mathbf{X}$ in terms of information carried by the associated underlying likelihood. Thus, it contains all points $\mathbf{X}^*$ such that the likelihood ratio $f_P^{(n)}(\mathbf{X})/f_P^{(n)}(\mathbf{X}^*)$ is P-independent, and so it corresponds to the *orbit* of equivalent points associated with $\mathbf{X}$. Given that, under H_0, the density $f_P^{(n)}(\mathbf{X}) = \prod_{ji} f_P(X_{ji})$ is by assumption exchangeable in its arguments, because $f_P^{(n)}(\mathbf{X}) = f_P^{(n)}(\mathbf{X}^*)$ for every permutation $\mathbf{X}^*$ of $\mathbf{X}$, then $\mathcal{X}^n_{/\mathbf{X}}$, or simply $\mathcal{X}_{/\mathbf{X}}$ by suppressing superscript n, contains all distinct permutations of $\mathbf{X}$. That is $\mathcal{X}_{/\mathbf{X}} = \{\bigcup_{\mathbf{u}^* \in \Pi(\mathbf{u})}[X(u_i^*), i = 1, \ldots, n]\}$. Therefore, since every element $\mathbf{X}^* \in \mathcal{X}_{/\mathbf{X}}$ is a set of sufficient statistics for P in H_0, $\mathcal{X}_{/\mathbf{X}}$ is a sufficient space. Conditional reference spaces $\mathcal{X}_{/\mathbf{X}}$ are also called *permutation sample spaces.* Moreover, since $\forall A \in \mathcal{A}$ the conditional probability $\Pr(A|\mathbf{X}) = \Pr(A|\mathcal{X}_{/\mathbf{X}})$ in H_0 is P-independent (**P.1** in Section 4), the pooled data set $\mathbf{X}$ can be considered as playng the role of ancillary statistics for the probem. And so, when $\mathbf{X}$ is *minimal sufficient* it is also *maximal ancillary* and unique, except for a permutation.

What is essential in the paired-data design is that in H_0 the distribution of X is symmetric with respect to 0 [5]. This condition can be achieved in two main situations: (A) when data are exchangeable within each unit, i.e. when $Y_{1i} \stackrel{d}{=} Y_{2i}$ $\forall i = 1, \ldots, n$, the Ys being paired responses, in which the difference of any two individual observations in $H_0^a : Y_1 \stackrel{d}{=} Y_2$ is symmetrically distributed around 0, and the set of differences $\mathbf{X} = \{X_i = Y_{1i} - Y_{2i}, i = 1, \ldots, n\}$ is sufficient for P. (B) when Y_{1i} is symmetric around μ_{1i} and Y_{2i} is symmetric around μ_{2i} without being homoscedastic (and so not exchangeable), then their difference $Y_{1i} - Y_{2i}$ is symmetric about 0 in $H_0^b : (\mu_{1i} - \mu_{2i} = 0,\ i = 1, \ldots, n)$. In both cases, however, $\mathcal{X}_{/\mathbf{X}} = \{\bigcup_{\mathbf{S}^* \in [-1,+1]^n}[X_i S_i^*, i = 1, \ldots, n]\}$ contains all points obtained by assigning signs $+$ or $-$ to differences in all possible ways. By the way, the paired-data design can be used to show that the exchangeability property is sufficient but not necessary for the permutation approach.

The fact that random effects Δ may depend on null errors X can be considered as an improvement with respect to traditional parametric approaches, though this may imply evident difficulties for estimation and prediction. On the one hand, this leads to assumptions that are much more flexible and much closer to reality. There are indeed many real problems in which the assumption of independence of effects on errors cannot be justified. For instance, this typically occurs when data are obtained by measurement instruments based on nonlinear monotonic transformations of underlying variables. On the other hand, it is to be noted that in permutation analysis the separate estimate of variance components is generally not required. As a consequence the statistical modeling may better fit researcher's requirements, results of analyses are more credible and their interpretation more clear. In addition, it is to be emphasized that in the NP framework, where the set of parameters is unspecified or infinite-dimensional, more than on parameters the inferential interest is generally on functionals, i.e. on functions of all parameters such as the so-called treatment effect Δ. So that it is not possible to separate the role of parameters of interest from the nuisance ones since they are confounded in Δ.

It is worth noting that when $\mathbf{X}$ is minimal sufficient in H_0, even if the parent likelihood model depends on a finite set of parameters only one of which is of interest, univariate statistics capable of summarizing the necessary information do not exist. So no parametric method can claim to be uniformly better than others. Indeed, conditioning on $\mathcal{X}_{/\mathbf{X}}$, i.e. by considering PT counterparts, improves the power behavior of any unbiased test statistic (Rao-Blackwell). However, in order to reduce the loss of information associated with using one single overall statistic, to take account of a set of complementary view-points it is possible to find solutions within the so-called multi-aspect methodology based on the NPC of several dependent PT, each capable of summarizing information on a specific aspect of interest for the analysis [5]. A procedure which may improve efficiency and interpretability of results. For instance, when of two unbiased partial PT even only one is consistent, their NPC is consistent.

3 Conditionality, Sufficiency and Permutation Testing Principles

Let us briefly recall the CP and the SP, as are used in parametric inference [1]. We consider these principles as key guides also for the NP approach and here we relate them to the PT principle.

The SP essentially states that: "*Suppose that we are working with the model $f_X(x,\theta)$ for the random variable X, according to which the data set $\mathbf{X}$ is observed, and also suppose that the statistic S is minimal sufficient for $\theta \in \Theta$. Then, according to the SP, so long as we accept the adequacy of the model, identical conclusions should be drawn from data $\mathbf{X}_1$ and $\mathbf{X}_2$ with the same value of S.*"

The CP states that: "*Suppose that C is an ancillary statistic for the problem, then any conclusion about the parameter or the functional of interest is to be drawn as if C were fixed at its observed value.*"

Basically, the rationale for adopting these principles in statistical inference considers typical examples as the following: suppose that data $\mathbf{X}$ can be obtained by means of one of two different measuring instruments, M_1 and M_2, and suppose the associated normally distributed models are respectively $X_1 \sim \mathcal{N}(\mu_1, \sigma_1)$ and $X_2 \sim \mathcal{N}(\mu_2, \sigma_2)$, with $\sigma_1 \ll \sigma_2$. If it is known which instrument has generated $\mathbf{X}$ it seems unavoidable to condition on the related (ancillary) model in any inference regarding μ, the value of σ is known or unknown. Moreover, in accordance with the SP the statistical estimator of unknown μ should be based on a, possibly minimal complete, sufficient statistic for it. In addition, if the nuisance parameter σ is unknown it is wise to stay at least on invariant statistics or on the notion of invariance of null rejection probability (according to the notion of similarity) with respect to it and so to condition on a possibly minimal sufficient statistic for it (via Rao-Blackwell). Indeed, by acting outside these principles related inferential conclusions can be biased, misleading and maybe impossible to be correctly interpreted.

Thus, in the general situation where the underlying distribution P is unknown, or it is too complex to deal with or its parameters are unspecified or are infinitely many, it is wise to condition on its minimal sufficient statistic in H_0, i.e. it is wise to condition on the pooled observed data $\mathbf{X}$ which is always sufficient for whatever $P \in \mathcal{P}$ and ancillary for the inferential problem. It is to be recognised that in the literature there is general agreement on the SP; whereas the CP, especially when the ancillary statistic C is not unique, gives rise to known questions and so it is somewhat doubtful. These doubts, however, do not apply to the PT approach when $\mathbf{X}$ is minimal sufficient and so maximal ancillary.

This kind of conditioning implies referring to the PT principle: "*If two experiments, taking values on the same sample space $\mathcal{X}$ with underlying distributions P_1 and P_2 give the same data $\mathbf{X}$, then two inferences conditional on $\mathbf{X}$ and obtained by using the same statistic T must be the same, provided that the exchangeability of the data is satisfied in H_0.*" Of course, it is intended that in order to obtain sensible inferences the distributional behaviour of statistic T in H_1 must be different from that in H_0, i.e. there must be a form of stochastic dominance of $(T|H_1)$ with respect to $(T|H_0)$.

On the one hand it should be emphasized that the PT principle works in accordance with both CP and SP since it satisfies both. On the other hand, the related conditional inference can be extended from the set of really observed units to the family of all populations whose associated distribution P satisfy the condition $f_P^{(n)}(\mathbf{X}) > 0$, so as to also include most of the problems in which the sample data are obtained by selection-bias procedures from a target population. However, it should be noted that, due to conditioning on sufficient statistics for all nuisance entities, the extension to a family of distributions is also typical of all parametric conditional inferences in the presence of nuisance parameters (Section 6). For instance, this feature is clearly enjoyed by Student's t whose inference can be extended from the observed data set $\mathbf{X}$ to all normal populations which assign positive density to the variance estimate $\hat{\sigma}^2$; thus its inference can be extended to a family of distributions more than to only the target one.

4 Main Properties of PT

In this section we briefly outline main terminology, definitions and general theory of PT for some one-dimensional problems. Emphasis is again on two-sample one-sided designs in which large values of test statistics $T : \mathcal{X}^n \to \mathcal{R}^1$ are evidence against H_0.

• **P.1.** *Sufficiency of $\mathcal{X}_{/\mathbf{X}}$ for P under H_0 implies that the null conditional probability of every event $A \in \mathcal{A}$, given $\mathcal{X}_{/\mathbf{X}}$, is independent of P; that is, with clear meaning of the symbols,* $\Pr\{\mathbf{X}^* \in A; P|\mathcal{X}_{/\mathbf{X}}\} = \Pr\{\mathbf{X}^* \in A|\mathcal{X}_{/\mathbf{X}}\}$.

Thus, the permutation distribution induced by any test statistic $T : \mathcal{X}^n \to \mathcal{R}^1$, namely $F_T(t|\mathcal{X}_{/\mathbf{X}}) = F_T^*(t) = \Pr\{T^* = T(\mathbf{X}^*) \leq t|\mathcal{X}_{/\mathbf{X}})\}$, is P-invariant. Hence, any related conditional inference is distribution-free and NP. Moreover, since for finite sample sizes the number $M = M^{(n)} = \sum_{\mathcal{X}_{/\mathbf{X}}} \mathbb{I}(\mathbf{X}^* \in \mathcal{X}_{/\mathbf{X}})$ of points in $\mathcal{X}_{/\mathbf{X}}$ is finite, a relevant consequence of both independence of P and finiteness of M is that in H_0 the permutation probability on every $A \in \mathcal{A}$ is calculated as

$$\Pr\{\mathbf{X}^* \in A|\mathcal{X}_{/\mathbf{X}}\} = \sum_{\mathbf{X}^* \in A} f_P(\mathbf{X}^*)\mathrm{d}\mathbf{X}^* \Big/ \sum_{\mathbf{X}^* \in \mathcal{X}_{/\mathbf{X}}} f_P(\mathbf{X}^*)\mathrm{d}\mathbf{X}^* = \sum_{\mathcal{X}_{/\mathbf{X}}} \frac{\mathbb{I}(\mathbf{X}^* \in A)}{M},$$

because $\forall \mathbf{X}^* \in \mathcal{X}_{/\mathbf{X}}$ it is $f_P(\mathbf{X}^*)\mathrm{d}\mathbf{X}^* = f_P(\mathbf{X})\mathrm{d}\mathbf{X}$. It is worth noting here that in calculating the conditional probability distribution it is not necessary to make reference to the so-called *hypothetical repeated sampling principle.* Actually, $\Pr\{\mathbf{X}^* \in A|\mathcal{X}_{/\mathbf{X}}\}$ is *objectively determined* by complete enumeration of $\mathcal{X}_{/\mathbf{X}}$ which has a physical existence, and so no hypothetical sampling experiment is referred to in its determination. Since in determining the permutation probability measure in H_0 knowledge of P, or of f_P, is not required, it is to be emphasized that *only the existence of a likelihood is required* by the permutation approach (if this existence cannot be assumed, no statistical problem is on the stage). One more relevant consequence of finiteness of $\mathcal{X}_{/\mathbf{X}}$ is that permutations $\mathbf{X}^*$ in H_0 are equally likely conditionally, i.e. $\Pr\{\mathbf{X} = \mathbf{x}|\mathcal{X}_{/\mathbf{X}}\} = \Pr\{\mathbf{X}^* = \mathbf{x}|\mathcal{X}_{/\mathbf{X}}\} = 1/M$ if $\mathbf{x} \in \mathcal{X}_{/\mathbf{X}}$ and 0 elsewhere. And so:

- **P.2.** *In H_0 the data set $\mathbf{X}$ is uniformly distributed over $\mathcal{X}_{/\mathbf{X}}$ conditionally.*
- **P.3.** (Uniform similarity of randomized permutation tests). *Let us assume that the exchangeability condition on data $\mathbf{X}$ is satisfied in H_0, then the conditional rejection probability $\mathbb{E}\{\phi_R(\mathbf{X})|\mathcal{X}_{/\mathbf{X}}\}$ of randomized test $\phi_R = 1$ if $T^o > T_\alpha$, $= \gamma$ if $T^o = T_\alpha$,* and $= 0$ if $T^o < T_\alpha$, *is $\mathbf{X}$-P-invariant for all $\mathbf{X} \in \mathcal{X}^n$ and all $P \in \mathcal{P}$, where: $T^o = T(\mathbf{X})$ is the observed value value of T on data $\mathbf{X}$, T_α is the α-size permutation critical value, and $\gamma = \left[\alpha - \Pr\left\{T^o > T_\alpha|\mathcal{X}_{/\mathbf{X}}\right\}\right] / \Pr\left\{T^o = T_\alpha|\mathcal{X}_{/\mathbf{X}}\right\}$.*

For non randomized PT such a property is satisfied in the almost sure form for continuous variables and at least asymptotically for discrete variables.

Determining the critical values T_α of a test statistic T, given the observed data $\mathbf{X}$, in practice presents obvious difficulties. Therefore, it is common to make reference to the associated p-value. This is defined as $\lambda = \lambda_T(\mathbf{X}) = \Pr\{T^* \geq T^o|\mathcal{X}_{/\mathbf{X}}\}$, the determination of which can be obtained by complete enumeration of $\mathcal{X}_{/\mathbf{X}}$ or estimated, to the desired degree of accuracy, by a conditional Monte Carlo algorithm based on a random sampling from $\mathcal{X}_{/\mathbf{X}}$ [5]. For quite simple problems it can be evaluated by efficient computing routines such as those in [3]; moreover, according to [4] it can be approximately evaluated by using a suitable approximating distribution, e.g. as within Pearson's system of distributions, sharing the same few moments of the exact permutation distribution, when these are known in closed form in terms of data $\mathbf{X}$.

The p-value λ is a non-increasing function of T^o and is one-to-one related with the attainable α-value of a test, in the sense that $\lambda_T(\mathbf{X}) > \alpha$ implies $T^o < T_\alpha$, and vice versa. Hence, the non-randomized version can be stated as $\phi = 1$ if $\lambda_T(\mathbf{X}) \leq \alpha$, and $= 0$ if $\lambda_T(\mathbf{X}) > \alpha$, for which in H_0 it is $\mathbb{E}\{\phi(\mathbf{X})|\mathcal{X}_{/\mathbf{X}}\} = \Pr\{\lambda_T(\mathbf{X}) \leq \alpha|\mathcal{X}_{/\mathbf{X}}\} = \alpha$ for every *attainable* α. Thus, attainable α-values play the role of critical values, and in this sense $\lambda_T(\mathbf{X})$ itself is a test statistic.

- **P.4.** (Uniform null distribution of p-values). *Based on* **P.1**, *if X is a continuous variable and T is a continuous non-degenerate function, then p-value*

$\lambda_T(\mathbf{X})$ *in* H_0 *is uniformly distributed over its attainable support.*
• **P.5.** (Exactness of permutation tests). *A PT T is exact if its null distribution essentially depends on exchangeable null error deviates* $\mathbf{X}$ *only.*
• **P.6.** (Uniform unbiasedness of test statistic T). *PT for random shift alternatives* ($\Delta \overset{d}{\geq} 0$) *based on divergence of symmetric statistics of non-degenerate measurable non-decreasing transformations of the data, i.e.* $T^*(\Delta) = S_1[\mathbf{X}_1^*(\Delta)] - S_2[\mathbf{X}_2^*(\Delta)]$, *where* $S_j(\cdot)$, $j = 1, 2$, *are symmetric functions of their entry arguments* $(\cdot)$, *are conditionally unbiased for every attainable* α, *every population distribution* P, *and uniformly for all data sets* $\mathbf{X} \in \mathcal{X}^n$. *In particular*: $\Pr\{\lambda(\mathbf{X}(\boldsymbol{\Delta})) \leq \alpha|\mathcal{X}_{/\mathbf{X}(\Delta)}\} \geq \Pr\{\lambda(\mathbf{X}(0)) \leq \alpha|\mathcal{X}_{/\mathbf{X}(0)}\} = \alpha$, *thus p-value in* H_1 *is stochastically dominated by that in* H_0, *i.e.* $\lambda(\mathbf{X}(\boldsymbol{\Delta})) \overset{d}{\leq} \lambda(\mathbf{X}(0))$

An immediate consequence of the latter is that, if $\Delta' \overset{d}{>} \Delta$ then $\lambda(\mathbf{X}(\boldsymbol{\Delta}')) \overset{d}{\leq} \lambda(\mathbf{X}(\boldsymbol{\Delta})) \overset{d}{\leq} \lambda(\mathbf{X}(0))$, the permutation p-values of any T are stochastically decreasingly ordered with respect to effect Δ. Without further assumptions related to the symmetry of induced permutation distributions, uniform unbiasedness cannot be extended to two-sided alternatives.

It is worth observing that uniform similarity (**P.3**) and uniform unbiasedness (**P.6**) since are at least satisfied for almost all data sets $\mathbf{X}$ under exchangeability in H_0, a property satisfied by randomization of units to treatments, do not require random sampling from a population. Thus, they work also for selection-bias sampling.
• **P.7.** (The empirical probability measure, EPM). *For each permutation* $\mathbf{X}^* \in \mathcal{X}_{/\mathbf{X}}$, *the EPM of any* $A \in \mathcal{A}$ *is defined as* $\hat{P}_{\mathbf{X}^*}(A) = \sum_{i \leq n} \mathbb{I}(X_i^* \in A)/n$ *which, since* $\forall \mathbf{X}^* \in \mathcal{X}_{/\mathbf{X}}$ *it is* $\sum_{i \leq n} \mathbb{I}(X_i^* \in A)/n = \sum_{i \leq n} \mathbb{I}(X_i \in A)/n = \hat{P}_{\mathbf{X}}(A)$, *is a permutation invariant function over* $\mathcal{X}_{/\mathbf{X}}$.

The latter implies that conditioning on $\mathcal{X}_{/\mathbf{X}}$ is equivalent to conditioning on the EPM $\hat{P}_{\mathbf{X}}(A)$, which then is sufficient too.
• **P.8.** (The power of test T). *The (unconditional or population) power of a PT T as a function of* Δ, α, T, P, *and* n *is defined as* $W(\Delta, \alpha, T, P, n) = \mathbb{E}_{P^n}[\Pr\{\lambda_T(\mathbf{X}(\boldsymbol{\Delta})) \leq \alpha|\mathcal{X}^n_{/\mathbf{X}}\}]$. *Of course,* $W(\Delta, \alpha, T, P, n) \geq W(0, \alpha, T, P, n) = \alpha, \forall \alpha > 0$, *since, in force of* **P.6** *the integrand is* $\geq \alpha$ *for all* $\mathbf{X} \in \mathcal{X}^n_{/\mathbf{X}}$, *all* $P \in \mathcal{P}$ *and all* n.

It is worth noting that **P.8** implies unconditional unbiasedness. It is also to be noted that the power determination of T implies referring to the hypotetical repeated sampling principle.

To introduce the weak consistency property of PT, stating that "*if* $\Delta \overset{d}{>} 0$, *as* $\min[n_1, n_2] \to \infty$ *the rejection probability of test T tends to one for all* $\alpha > 0$", let us first consider sequences of related data sets where first n_1 IID values are from $X_1(\Delta) = X + \Delta$ and the other n_2 from $X_2 = X(0) = X$. Such sequences are denoted by $\{\mathbf{X}^{(n)}(\Delta)\}_{n \in \mathbb{N}} = \{[X_{11} + \Delta_1, \ldots, X_{1n_1} + \Delta_{n_1}, X_{21}, \ldots, X_{2n_2}]\}_{(n_1, n_2) \in \mathbb{N}}$. Of course, $\{\mathbf{X}^{(n)}(0) = \mathbf{X}^{(n)}\}_{n \in \mathbb{N}}$ represents sequences in H_0. Besides, we assume that $n \to \infty$ implies $\min[n_1, n_2] \to \infty$.
• **P.9.** (Weak Consistency). *Let X be any population variable and suppose*

that $\{\mathbf{X}^{(n)}(\Delta)\}_{n\in\mathbb{N}}$ *is a sequence of data the first* n_1 *IID from* $(X_1(\Delta), \mathcal{X})$ *and independently the other* n_2 *IID from* $(X, \mathcal{X})$*. Suppose that the null distribution of* X *is* $P \in \mathcal{P}$*, and let* $\varphi : \mathcal{X} \to \mathcal{R}^1$ *be any non-decreasing and non-degenerate measurable function. Suppose also that*: a) *the* φ*-mean* $\mathbb{E}_P[\varphi(X)] = \mathbb{E}_P[\varphi(X(0))]$ *is finite, i.e.* $\mathbb{E}_P[|\varphi(X)|] < +\infty$; b) *the finite* φ*-mean in* H_1 *is such that* $\mathbb{E}_P[\varphi(X(\Delta))] > \mathbb{E}_P[\varphi(X(0))]$ *for every* $\Delta \overset{d}{>} 0$; c) *the PT is based on* $T^* = \frac{1}{n_1}\sum_{i\leq n_1}\varphi(X_i^*)$*, or on permutationally equivalent statistics. Then, for every* $\alpha > 0$, a), b), *and* c) *imply that the rejection probability of the PT* ϕ*, associated with* T^**, converges weakly to one as* $n \to \infty$*.*

It is worth noting that population variable X can be either real, or ordered categorical, and that its transformation $\varphi(X)$ is real, i.e. continuous, discrete, or mixed. As an application of **P.9** we see details for proving consistency of a test based on well-known Cramér–von Mises statistic for one-sided alternatives. Indeed: i) with $\Delta \overset{d}{>} 0$, $T^*_{CM} = \sum_{i=1}^{n}[\hat{F}_2^*(X_i) - \hat{F}_1^*(X_i)]$, where $\hat{F}_j^*(z) = \sum_i^{n_j}\mathbb{I}(X_{ji}^* \leq z)/n_j$, $j = 1, 2$, is permutationally equivalent to $-\sum_{i\leq n}\hat{F}_1^*(X_i)/n$, since $\hat{F}_{\mathbf{X}^{(n)}}(t) = [n_2\hat{F}_2^*(t) + n_1\hat{F}_1^*(t)]/n$ is a permutation invariant function; ii) as F_P is bounded, $\mathbb{E}_P(F_P(X))$ is finite; iii) as $\hat{F}_1^*$ is a sample mean, we have that $\Pr\{|\hat{F}_1^*(z) - \hat{F}_{\mathbf{X}^{(n)}}(z)| < \varepsilon|\hat{F}_{\mathbf{X}^{(n)}}\} \longrightarrow 1$, $\forall z \in \mathcal{R}^1$ and $\varepsilon > 0$; iv) $\Delta \overset{d}{>} 0$ implies $\mathbb{E}_P[F_P(X(\Delta))] < \mathbb{E}_P[F_P(X(0))]$. Therefore, since conditions a), b) and c) are satisfied, T^*_{CM} is weakly consistent.

5 The Permutation Empirical Likelihood (PEL)

Suppose now that effects are fixed: $\Pr\{\Delta = \delta\} = 1$. The monotonicity property of p-values, as stated in **P.6,** such that if $\delta' \overset{d}{>} \delta$ then $\lambda[\mathbf{X}(\delta')] \overset{d}{\leq} \lambda[\mathbf{X}(\delta)] \overset{d}{\leq} \lambda[\mathbf{X}(0)]$, enables us to define the so-called PEL induced by T given $\mathbf{X}$ which, although derived differently from that introduced in the literature by Owen in 1988, may be seen as a form of empirical likelihood. To this end, given the pair $(T, \mathbf{X})$, and with obvious notation, p-values may also be expressed by

$$\lambda[\mathbf{X}(\delta)] = \int_{T^o(\delta)}^{\infty} \mathrm{d}F_T[(t;\delta)|\mathcal{X}_{/\mathbf{X}}] = \sum_{t\geq T^o(\delta)} \Pr\{T^*(\delta) = t|\mathcal{X}_{/\mathbf{X}}\},$$

where, of course, the sum includes all points t of the conditional support $\mathcal{T}(\mathbf{X}(\delta)) = \{T(\mathbf{X}^*(\delta)),\ \mathbf{X}^* \in \mathcal{X}_{/\mathbf{X}}\}$ of T which are not smaller than $T^o(\delta)$, and the CDF $F_T[(t;\delta)|\mathcal{X}_{/\mathbf{X}}]$ for $t \in \mathcal{R}^1$ is obtained by considering the pooled data set $\mathbf{X}(\delta) = \mathbf{X}_1(\delta) \biguplus \mathbf{X}_2$. Note that the cardinality of $\mathcal{T}(\mathbf{X}(\delta))$ is related to that of $\mathcal{X}_{/\mathbf{X}}$. When there are no ties, the two sets share the same cardinality with probability one. Thus, in general, $\mathrm{d}F_T[(t;\delta)|\mathcal{X}_{/\mathbf{X}}] = 1/M$ if $t \in \mathcal{T}(\mathbf{X}(\delta))$ and zero elsewhere, the differentiation is with respect to t.

However, depending on δ and $\mathbf{X}(\delta)$, and so also on n, points in $\mathcal{T}(\mathbf{X}(\delta))$ tend to concentrate, in the sense that for any $\varepsilon > 0$ the probabiity of points in the interval $t \pm \varepsilon$ is $F_T[(t+\varepsilon;\delta)|\mathcal{X}_{/\mathbf{X}}] - F_T[(t-\varepsilon;\delta)|\mathcal{X}_{/\mathbf{X}}] = \mathrm{D}_\varepsilon F_T[(t;\delta)|\mathcal{X}_{/\mathbf{X}}]$. From this point of view, similarly to a naive kernel estimate, the quantity

$\mathrm{D}_\varepsilon F_T[(t;\delta)|\mathcal{X}_{/\mathbf{X}}]/2\varepsilon$ may be considered similar to a NP density estimate of points around t given δ. Therefore, for fixed values of t, the behaviour of $f_T^{(\varepsilon)}[(t;\delta)|\mathcal{X}_{/\mathbf{X}}] = \mathrm{D}_\varepsilon F_T[(t;\delta)|\mathcal{X}_{/\mathbf{X}}]/2\varepsilon$ is formally similar to that of a likelihood function for δ. We may call this quantity the *smoothed PEL* of T given $\mathbf{X}$. In this sense, the p-value of T, given $\mathbf{X}$, corresponds to a form of *integrated PEL induced by* T. Indeed, we may write $\lambda[\mathbf{X}(\delta)] \simeq \int_{T^o(\delta)}^{\infty} f_T^{(\varepsilon)}[(t;\delta)|\mathcal{X}_{/\mathbf{X}}]\mathrm{d}t$.

For practical purposes, if any, in order to obtain evaluations of $f_T^{(\varepsilon)}[t;\delta|\mathcal{X}_{/\mathbf{X}}]$ we can choose the window bandwidth for instance as $\varepsilon \simeq 1.06 s_T^*/M^{1/5}$, where $s_T^* = \min\{\sigma_T^*, (T_{Q3}^* - T_{Q1}^*)/1.34\}$ in which $\sigma_T^* = \sqrt{\mathbb{E}[T^* - \mathbb{E}(T^*)]^2\}}$ is the permutation standard deviation, and T_{Q3}^* and T_{Q1}^* are the third and first quartiles of T^*. When sample sizes tend to the infinity, so that points in $\mathcal{T}(\mathbf{X}(\delta))$ become dense, the PEL $f_T^{(\varepsilon)}[(t;\delta)|\mathcal{X}_{/\mathbf{X}}]$ converges to a proper likelihood function.

However, as the PEL is induced by a test statistic T, given $\mathbf{X}$, it should be emphasized that in general $f_T^{(\varepsilon)}[(t;\delta)|\mathcal{X}_{/\mathbf{X}}]$ cannot be directly used to find a *best* NP estimator for δ because T is pre-established with respect to any consequent inference. Moreover, it is worth noting that, similarly to most permutation entities, the PEL $f_T^{(\varepsilon)}[(t;\delta)|\mathcal{X}_{/\mathbf{X}}]$ cannot be expressed in closed form.

5.1 On Bayesian Permutation Inference

We may use the concept of the PEL induced by $(T, \mathbf{X})$ on a functional δ in order to define a kind of Bayesian permutation inference, in terms of tests of hypotheses, estimators and confidence intervals on δ, etc. Of course, similarly to parametric contexts, a Bayesian permutation approach implies referring to a prior distribution $\pi(\delta)$ for δ.

From this point of view, in general a functional such as δ is a function of all parameters defining P within $\mathcal{P}$. Of course associated with P there is the likelihood $f_T(t;\delta,P)$ induced by T. Therefore, the Bayesian permutation approach is slightly different from the traditional Bayesian parametric approach. In fact, the former is NP and strictly conditional on the observed data set $\mathbf{X}$. Furthermore, although it is essentially different from the NP Bayesian approach introduced by Ferguson in 1973, it is of interest as a further way of inference. For instance, if we use $\pi(\delta)$ to denote the prior density for δ, which should be defined over $(\Omega, \mathcal{A}_\Omega)$, where Ω is the sample space for δ and $\mathcal{A}_\Omega$ is a σ-algebra of subsets of Ω, then the *posterior permutation distribution,* given $(T, t, \mathbf{X})$, is

$$\pi_T(\delta|(t,\mathbf{X},\varepsilon)) = \pi(\delta)\cdot f_T^{(\varepsilon)}[(t;\delta)|\mathcal{X}_{/\mathbf{X}}] \Big/ \int_\Omega f_T^{(\varepsilon)}[(t;\delta)|\mathcal{X}_{/\mathbf{X}}]\cdot\pi(\delta)\,\mathrm{d}\delta\ ,$$

where the roles played by test statistic T, sample point $t \in \mathcal{T}(\mathbf{X})$, and prior distribution π are emphasized. Of course, the most important sample point t to consider is the observed value $T^o = T(\mathbf{X})$. For instance, the *best* Bayesian permutation estimate of δ under quadratic loss, given $(T, \mathbf{X})$, assuming that $\mathbb{E}[\delta^2|(T^o, \mathbf{X},\varepsilon;\pi)]$ is finite, is the posterior mean $\hat{\delta}_{\mathbf{X},\pi} = \int_\Omega \delta\pi_T(\delta|(T^o,\mathbf{X},\varepsilon))\mathrm{d}\delta$, and the *best* $(1-\alpha)$ Bayesian permutation confidence interval, based on the notion of highest posterior density provided that this is sufficiently regular, is

$\underline{\delta}_{\mathbf{X},\pi} \leq \delta \leq \bar{\delta}_{\mathbf{X},\pi}$ in such a way that $\pi_T(\underline{\delta}_{\mathbf{X},\pi}|(T^o,\mathbf{X},\varepsilon)) = \pi_T(\bar{\delta}_{\mathbf{X},\pi}|(T^o,\mathbf{X},\varepsilon))$, and

$$\int_{\underline{\delta}_{\mathbf{X},\pi}}^{\bar{\delta}_{\mathbf{X},\pi}} \pi_T(\delta|(T^o,\mathbf{X},\varepsilon))\,\mathrm{d}\delta = 1-\alpha.$$

It is worth noting that the Bayesian permutation inference, since it is strictly conditional on $\mathcal{X}_{/\mathbf{X}}$, i.e. on the data set $\mathbf{X}$, due to sufficiency of $\mathcal{X}_{/\mathbf{X}}$ is completely unaffected by the underlying distribution P. This implies a noticeable difference with respect to the parametric Bayesian inference based on the posterior distribution $\pi_T(\delta|\mathbf{X},P)$, which too is conditional with respect to the data set $\mathbf{X}$ but through the population likelihood f_P. For instance, two researchers with the same prior $\pi(\delta)$, the same pair $(T,\mathbf{X})$, but with different likelihoods, f_1 and f_2, arrive at exactly the same inference within the Bayesian permutation approach, since the posterior permutation distribution $\pi_T(\delta|(t,\mathbf{X},\varepsilon))$ does not depend on fs; whereas within the traditional Bayesian approach they may arrive at different inferences, since their posterior distributions are $\pi_T(\delta|\mathbf{X},f_1)$ and $\pi_T(\delta|\mathbf{X},f_2)$ respectively.

6 Extending Permutation Inference

The non-randomized permutation test ϕ associated to a given test statistic T based on divergence of symmetric functions of the data, possesses both conditional unbiasedness and similarity properties, the former (**P.6**) satisfied by *all population distributions* P *and all data sets* $\mathbf{X} \in \mathcal{X}^n$, the latter (**P.3**) satisfied for continuous, non-degenerate variables and *almost all data sets*. These two properties jointly suffice to weakly extend conditional inferences to unconditional or population ones, i.e. for the extension of conclusions related to the specific set of actually observed units (e.g. *drug is effective on the observed units*) to conclusions related to the population from which units have been drawn (e.g. *drug is effective*). Such an extension is done with weak control of inferential errors. With clear meaning of symbols let us observe:

• (i) for each attainable α and all sample sizes n, the similarity property implies that the power of the test under H_0 satisfies $W(0,\alpha,T,P,n) = \alpha$, because $\Pr\{\lambda(\mathbf{X}(0)) \leq \alpha|\mathcal{X}^n_{/\mathbf{X}}\} = \alpha$ for almost all samples $\mathbf{X} \in \mathcal{X}^n$ and all continuous non-degenerate distributions P, independently of how data are selected;

• (ii) the uniform conditional unbiasedness implies that (**P.8**) the unconditional power is $W(\Delta,\alpha,T,P,n) \geq \alpha$, for all distributions P, independently of how data are selected and provided that $f_P^{(n)}(\mathbf{X}) > 0$.

As a consequence, if for instance the inferential conclusion related to actual data $\mathbf{X}$ is in favour of H_1, so we say that "data $\mathbf{X}$ are evidence of treatment effectiveness on actually observed units", due to (i) and (ii) we are allowed to say that this conclusion is also valid unconditionally for all populations $P \in \mathcal{P}$ such that $f_P^{(n)}(\mathbf{X}) > 0$. Thus, the extended inference becomes "treatment is likely to be effective". The condition $f_P^{(n)}(\mathbf{X}) > 0$ implies that inferential extensions must be carefully interpreted. To illustrate this aspect simply, let us consider an example of an experiment in which only males of a given population of animals are observed. Hence, based on the result actually obtained, the inferential extension from the observed units to the selected sub-population is immediate. Indeed, on the one hand, rejecting the null hypothesis with the actual data means that *data are evidence for a non-null effect of treatment*, irrespective of how data are collected, provided that they are exchangeable in the null hypothesis. On the other hand, if females of that population, due to the selection procedure, have a probability of zero of being observed, then in general we can say nothing reliable regarding them, because it may be impossible to guarantee that the test statistic used for male data satisfies conditional unbiasedness and/or similarity properties for female data as well. For instance, effect may be positive on male and negative on female. In general, *the extension* (i.e. the extrapolation or the inductive generalization) *of any inference to populations which cannot be observed can be formally done only with reference to assumptions that lie outside those that are adopted under the control of experimenters while working on actual data.* For instance, extensions to humans of inferences obtained from experiments on animals essentially require specific hypothetical assumptions.

We observe that for parametric tests, when there are nuisance entities to remove, the extension of inferences from conditional to unconditional can generally be done only if the data are obtained through well-designed sampling procedures applied to the entire target population. When selection-bias data $\mathbf{X}$ are observed and the selection mechanism is not well designed and/or modelled there is no point in staying outside the conditioning on the associated sufficient orbit $\mathcal{X}_{/\mathbf{X}}$ and the related distribution induced by the chosen statistic T. On the one hand this implies adopting the permutation testing principle; on the other, no parametric approach can be invoked to obtain credible inferential extensions.

7 A few References

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Bayesian Statistical Inference: an Overview

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Abstract. This relation expounds the main characteristics of the Bayesian approach, pointing out also the differences among the many Bayesian philosophies. The first feature of any Bayesian procedure is the assignment of a probability to any event. This can be accomplished through the subjective approach to probability (in the sense of de Finetti) and, at the other extreme, through the so-called objective approach stemming from the traditional search for noninformative priors. A further characteristic of the Bayesian methods is conditioning on the observed data. Thus the Likelihood Principle is automatically respected and a major disagreement with the frequentist procedures arises. Some comments are also given about topics where the Bayesian approach seems (at least to Bayesians) more suitable than the alternatives. These include the elimination of nuisance parameters, the possibility of explicitly dealing with prediction problems, the possibility of a complete treatment of the design of experiments. At last short comments are provided about the relation with the decision-theoretic approach.

1. An historical outline

In the second half of the XIX century the dominant approach to statistical inference was the framework originated by P.S.Laplace, where an honour place was given to Bayes theorem. Both Bayes and Laplace are sometimes mentioned as supporters of a very strict approach to probability and inference: in the presence of the classical problem of the *probability of causes*, they would assume an equal probability for the causes, so that, in a modern language, the final probabilities would be proportional to the likelihoods. As shown by authoritative historians, this picture is not correct. Indeed Bayes in his famous 1763 paper (published after his death) assumed equal *prior predictive probabilities* (that is probabilities of observables) so that the equiprobability of causes was derived as a consequence (Stigler, 1982 and 1986). The *Principle of Indifference* formulated by P.S.Laplace in 1774 states that the ratio of the final probabilities of two causes A_i and A_j conditional on an event E equals the likelihood ratio $P(E|A_i)/P(E|A_j)$. This amounts to say that the initial probabilities of the causes are equal. But in many places Laplace himself explains that when the cases at hand are not equally possible, one has to subdivide or join them to reach a set of equipossible cases. Therefore, even for Laplace, equiprobability is the result of an elaboration, not a prioristic assumption. It has also been observed (Stigler, 1986, pp. 135 and 136) that in some occasions Laplace explicitly adopted non uniform priors. It is also relevant to remind that in his *Philosophical Essay on Probabilities* (1814), where Laplace resumed much of his work on the subject, it is imagined an unbalanced coin, so that the it is certain that in the long run the frequency of heads will differ from the frequency of tails. Not knowing whether the unbalancing will favour head or tail, Laplace states that the same probability must be given to head and tail. This is a clear example of a probability which is justified by a subjectivistic approach but which at the same time is unacceptable from a frequentist viewpoint. Indeed, the influent treatise by J.Bertrand (1907) measures the subjective probabilities through the comparison with a standard. Also Karl Pearson in most of his works is clearly sympathetic with the approach based on the so-called *inverse probabilities* (see e.g. Dale, 1991), and his influence was relevant at least until the first decades of

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the XXth century. On the other hand many authors remarked that a uniform prior would be approximately justified in the case of large sample size, a position that was deepened in modern times.

The comments above show that the Laplace paradigm for a long time was considered flexible enough to face most of the concrete problems of statistics. The break in the tradition is essentially due to the work of R.A. Fisher. His most ambitious contribution in this period is Fisher (1922) , where in Section 1 under the polemical title "The Neglect of Theoretical Statistics".there is even a severe criticism of a famous paper by K. Pearson (Pearson, 1920). Fisher's offensive, followed after a few years by the well known contributions of J.Neyman and E.S.Pearson, provoked an eclipse of the Bayesian approach for about three decades (Zabell, 1989). This does not mean that in the same period remarkable developments in the Bayesian framework did not occur. On the contrary, in the same period, important works by H.Jeffreys, I.J.Good, F.P. Ramsey and B.de Finetti were published ; the point is that the statistical community paid very few attention to such works, whose relevance was recognized only many decades later. The change occurred since the 50's (of the XX century) with the work of some scholars, including L.J.Savage (1954), H.Raiffa and R.Schlaifer (1961), D.V.Lindley (1965). English translations of some key works of de Finetti were provided. In the 70's several books were published were a definitive setting was given to the Bayesian theory. These include DeGroot (1970), de Finetti (1970), Box and Tiao (1971), Lindley (1972), Berger (1985). In the Italian literature the most relevant for the period are the books by Daboni and Wedlin (1982) and by Cifarelli and Muliere (1989). For more bibliographical details see Fienberg (2005); extensive historical information is given in Fienberg (1992, 2006).

Let us assume a standard statistical model, say $\{p(x|\theta),\ x\in\mathcal{X},\ \theta\in\Theta\}$, where the x's are the possible results, the θ's are the unknown parameters and p is a density or a mass function, and let x_{obs} the observed result. If the goal is to make inferences on the unknown parameter θ, a Bayesian statistician of any century should first of all complete the model adding a probability law (the *prior distribution*) for the parameter, say $\pi(\theta)$. Then he/she can use the celebrated Bayes' formula

$$\pi(\theta|x_{obs}) \propto \pi(\theta)p(x_{obs}|\theta)$$

which provides the *posterior* probability distribution for the parameter, i.e. the probability distribution updated with respect to the acquired information. The use of priors is the most evident difference between Bayesian and non Bayesian methods and the concept has been constantly debated. A more detailed analysis of the issue will be given in the following Section.

Automatically, the use of Bayes' formula implies that the probabilities (or densities) $p(x|\theta)$ with $x \neq x_{obs}$ have no effect on the analysis. On the contrary the frequentist approach to statistical inference produces conclusions which depend on the whole statistical model, not only on the likelihood function

$$L(\theta|x_{obs}) = p(x_{obs}|\theta).$$

In this writer's opinion this aspect, that is the violation of the so-called *Likelihood Principle*, is what mostly moves the frequentist approach away from the Bayesian approach. In fact the lack of explicit priors is many times replaced by other more or less equivalent choices (for instance the choice of the probability of errors of the first kind instead of the prior probabilities of the hypotheses, in a simple testing problem). More comments on this issue will be given in Section 3.

2. Prior probabilities

In the first decades of the XXth century the concept of probability was studied in great depth. One approach sees the probability as a limit of observable frequencies, an interpretation which is not very suitable for the Bayesian methodology because very rarely the prior probabilities can be interpreted in this way, Another approach, originated independently by F.P. Ramsey (1926) and B. de Finetti (1931), much more refined than the conceptions common in the previous century, was based on the so called *subjective* or *personal* probability. It is plain that the probability as a measure of belief in the occurrence of an uncertain event has a general applicability. The most known operational definition assumes a bet on an uncertain event and specifies the probability as the fair price of a unitary stake. A bet where the subject loses whatever happens is currently called a *Dutch* book. Then de Finetti introduced the principle of *coherence*, i.e. that a subject must avoid Dutch books, and showed that the principle is equivalent to the standard Kolmogorov axioms of probability (not considering the complete additivity, which turns out to be a possible but non necessary choice). Moreover de Finetti (1937) formulated the problem of inference as prediction of the future results given a partial initial trajectory of the stochastic process of observables. This formulation does not introduce unknown parameters and replaces the standard notion of random sampling from a partially unknown population with the concept of *exchangeability*. At a first sight this approach is radically different from the standard one, popularized by Fisher and Neyman and based on the usual statistical models. Indeed the celebrated *de Finetti representation theorem* shows that exchangeability corresponds to conditional independence and that the procedure based on prior plus likelihood is essentially equivalent to the completely predictive approach, since the assumptions on the process also determine prior and likelihood.

As mentioned before, for many years the statistical community showed a lack of interest in any Bayesian approach and, even the few Bayesian statisticians maybe did not seriously consider the predictive approach. The collaboration between de Finetti and Savage in the 50's contributed very much to the revival of the Bayesian approach in general, in particularto the the acceptance of subjective probabilities. The influence of de Finetti on Savage is clear for instance in Savage (1962), while the influence of Savage on de Finetti is clear for instance in de Finetti (1959). Note that in the chapter XII of de Finetti (1970), after a short premise about its connection with the predictive approach, the problems of inference is directly treated in the current model-based framework A common way to use the original predictive approach by de Finetti is to "justify" the model-based approach through the representation theorem; see e.g. Dawid (1982). The most systematic treatment in this framework was given by Bernardo and Smith (1993). A claim in favour of the predictivistic approach, conforming to the original proposal by de Finetti, was presented by Cifarelli and Regazzini (1982) and remarkable methodological researches were conducted under this perspective. For instance Regazzini (1991) explored the use of such approach in a nonparametric inferential context. Less common are treatments oriented to applied problems; the exceptions include Muliere and Petrone (1993) and Spizzichino (2001). A general treatment of de Finetti's work in mathematical statistics cannot be given here, and we refer to Cifarelli and Regazzini (1996), Bernardo (1998) and Piccinato (1986, 2010) and the references therein. The implementation of the subjectivistic paradigm requires a new interest for the problem of elicitation, i.e. how to put in a probabilistic form the knowledge owned by the experts. Many papers were dedicated to this topic, starting with de Finetti and Savage (1962). For a recent systematic review see O'Hagan et al (2006). A concept by de Finetti which found only a limited acceptance among statisticians was finite additivity (for a deepening see Cifarelli and Regazzini, 1996). It is known however that complete additivity allows to use properties which hold in the finite problems (for instance conglomerability) so that its adoption is natural when infinity appears essentially as an approximation of large or unprecised numbers. For special problems, when infinity has its own specific role, resorting to finite additivity can be clarifying also in practical settings (see e.g. Scozzafava, 1984).

In the 60's the classical argument about the almost irrelevance of the prior in the presence of a significant experimental information (the *Principle of Precise Measurement*) was reconsidered and clarified (Savage, 1962; Edwards, Lindman and Savage, 1963). This result has a connection with the recurrent idea of using *noninformative* priors. In the classic period the uniform distribution was often and naively used in this sense, though many authors remarked that the uniformity is not maintained under one-to-one transformations, while on the contrary noninformativity should not disappear. Stigler (1986 p.127) mentions that such a criticism was expressed by F.Y.Edgeworth in 1885. It was H.Jeffreys who introduced in the 30's his *invariant rule*, where the invariant prior turns out to be proportional (in the univariate case) to the square root of the quantity which will be later named *Fisher expected information.* The concept of noninformativeness, to take it seriously, has surely very weak bases: a probability distribution always represent an information. This explains why a multiplicity of different proposals were advanced in the years (see Kass and Wasserman, 1993). One of these proposals, cautiously named *reference prior*, received much consent and is now almost a standard, a kind of *default* procedure. The proposal originated by a paper by J.M.Bernardo (1979); for complete treatments see Berger and Bernardo (1992) and Berger, Bernardo and Sun (2009) . Such proposal, with a motivation based on the idea of looking for the prior which maximizes the missing information about the unknown parameter, coincides with the Jeffreys invariant rule for one-dimensional parameters. This coincidence is lost in the multiparameter case because the treatment of the components is not symmetric, which is justified by the distinction between parameter of interest and nuisance parameter. A criticism to this procedure is that it entails a violation of the Likelihood Principle, since the posterior distribution depends not only on the likelihood function but also on the model (see e.g. Lindley in the discussion of Bernardo, 1979). It could be remarked that this kind of prior (as Jeffreys') is necessarily connected with the model since it is obviously impossible to speak of minimal information in an absolute sense; compatibility with the Likelihood Principle is hold by Bernardo (2005, Section 3.6).

The availability of an agreed default rule, where no effort of elicitation is required, suggested an approach which is now called *Objective Bayesian Analysis* . For a comparison of the contrasting arguments see Berger (2006), Goldstein (2006) and the related discussion. The same proponents of the objective approach (Berger, Bernardo and Sun, 2009) remark however that the term "objective" means that it only depends on the model assumed and the data obtained, so that the kind of objectivity is simply the same of the frequentist statistics. There are significant practical and logical differences with a pure subjectivistic approach, but, in the present writer's opinion, these are only variants of a more general Bayesian framework. As mentioned before, I think that the qualification "Bayesian" is due when we assume that any uncertain event must have a prior probability. It is not necessary that there exists a subject who has effectively such information. In any case the Bayes theorem explains how to update an information, be it effective or conventional. The common procedures used for specifying the prior form almost a *continuum* between the pure subjectivity and the maximum of objectivity (which in any case requires some personal choice, for instance the information measure to be used).

In order to simplify the elicitation process many suitable partial formalizations are in use. Among the most known tools there are the conjugate classes of priors, that is classes for the prior such that for any result the posterior distribution belongs to the same class. The concept had a systematic treatment by Raiffa and Schlaifer (1961) but the same proposal (often limited to the binomial model) appeared many times much before. Until the availability of the MCMC techniques it was often difficult to get the posterior distributions unless the prior was a member of a conjugate class. On the base of the de Finetti representation theorem Lindley (1971) represented exchangeable parameters through a hierarchical model. This (see also Lindley and Smith, 1972) allowed a very convenient Bayesian treatment of the general linear model. These procedures are not meant to provide "objective" priors, because much is left again to elicitation, but in any case they are instrumental in order to partially formalize prior information.

In the last decades procedures pointing at strongly conventional priors, that is priors even not coincident with the real probability evaluated by the subject, were suggested and proved useful in applications. For instance, the book by Spiegelhalter *et al*. (2004) made popular the use of *sceptical* priors, mainly in a clinical context. It is clear that a medical treatment convincing a sceptical subject is more easily accepted than a treatment whose probability of success is evaluated starting from an initial subjective probability. On the other hand, if the final probability of success of a treatment is not good even with an *enthusiastic* prior, there is no reason of pursuing the study. Another technique of modelling the prior is the use of *power priors*, initially proposed by Ibrahim and Chen (2000), that is suitable when there are historical data similar to those at hand but not worth to be considered an exchangeable sample (see also De Santis, 2007). Then the information provided by the historical data is formalized through a likelihood raised to an exponent α ($0 \leqslant \alpha \leqslant 1$) where α is a measure of reliability ($\alpha=1$ means that the historical data are considered as they were part of the actual sample).

Another departure from an ideal subjectivistic practice is the distinction, now very much used, between *design* prior and *analysis* prior. This idea appears from the first time in Tsutakawa (1972) and was developed also by Etzioni and Kadane (1993). The title of the later paper shows a situation where it is natural that the prior used in the stage of the design and in the stage of analysis differ. Moreover, for technical reason (the possibility of getting *proper* prior predictive distributions) it is convenient that the design prior is proper. On the contrary, many *default* priors used in the analysis are improper and this usually does not create any problem. It was also suggested (Wang and Gelfand, 2002) that the design prior do not privilege the regions of the parameter space which are initially more probable but those which could make the results more interesting.

3. Statistical models and Likelihood Principle

In the framework of a standard statistical model the Likelihood Principle has, in the present writer's opinion, his own logical strength even without considering its automatic validity under the Bayesian paradigm. Savage, in the discussion of Birnbaum (1962) writes that he came to Bayesian statistics seriously only through recognition of the Likelihood Principle. The issue is however controversial; for instance Cox (2006, p.47) comments that the principle is convincing in its weak version (two results under the same model are equivalent when the likelihood functions are proportional) but qualifies "less compelling" the strong version (when it is not required that the model is fixed). It is well known that among the merits of Fisher there is the introduction of the likelihood function (Fisher, 1922). His attitude about the Likelihood Principle has been largely discussed; for a thorough analysis see Savage (1976). The formal definition is due to Birnbaum (1962), but the argument was already informally in use. Many Bayesian authors stress the relevance of the principle in the context of a Bayesian analysis, as Edwards, Lindman and Savage (1963), Lindley (1972) and the likelihood literature is a source of interest for the Bayesian school (we could mention at least Basu, 1975, and Royall, 1997). A definitive treatment is Berger and Wolpert (1988).

It is worth noting that a Bayesian attitude is favoured also by arguments whose goal is less radical, that is to recommend the practice of conditioning on the ancillary statistics. One of the most famous examples, the case of the two laboratories, is presented in Cox (1958). The two laboratories provide an unbiased measure of some characteristic but have different (known) sampling variances. If we choose one laboratory at random and get the measure, the complete result can be written as (i,x) where i denotes the laboratory and x the measure. A rigid applications of the *repeated sampling principle* (for instance as shortly reminded in Neyman, 1971) would require that the sampling distribution of the statistic x has a variance which is the aritmetic average of the two sampling variances associated to the two laboratories, allowing for the fact that the observed laboratory will change in the hypothetical repetitions. This example shows that a rigid application of the frequentist rule, that is the privilege given to the long run performances of the statistics, can be untenable, while if one conditions on a suitable ancillary statistic (the statistic *i* in the example) the paradox disappears. Of course in a Bayesian analysis of the problem no paradox occurs since the conditioning involves both the components of the result.This kind of examples took many years to became popular (with the exception of the Bayesian literature), at least in the textbooks. I can just mention that E.L.Lehmann, in the second edition (1986) of his classic *Testing Statistical Hypotheses,* added a last chapter ("Conditional inference"), where the topic is thoroughly examined and a serious comment on the suitability of the unconditional approach is provided (p.541): "if repetitions [...] are potential rather than actual interest will focus on the particular event at hand , and conditioning seems more appropriate"). No surprise that in his recent survey of the inferential theories Cox (2006) warns from the beginning about the necessity of "ensuring, as far as is feasible, the relevance of the long run to the specific instance" (p. 8). Therefore the comparison among the main theories of inference involves more the comparison between choosing a conditioning statistic and choosing a prior distribution, than opting for an objective or a subjective approach. Let us finally mention that recent researches by Bayesian authors about the relationships between the different inferential approaches (Berger, 2003; Bayarri and Berger, 2004) give a special role just to the conditional frequentist approach.

The main advantage of the model-based approach is the possibility of separating the different sources of information, i.e. the pre-experimental information, inbedded in the prior, and the experimental information, inbedded in the likelihood function (though in the setting defined by the model). However, this approach is not completely general for inference problems. Difficulties in finding an agreed definition of the likelihood function were considered in Bayarri, De Groot and Kadane (1988). In any case, however, a Bayesian can resort to the completely predictive approach in the sense of de Finetti, though this could force to reformulate inferential problems.

4. The development of Bayesian methodology

Many hints to the development of Bayesian methodology were provided by the existing frequentist methodology: problems which had a solution in a non-Bayesian approach had to be revised and reformulated. I shall comment some examples, chosing among the most relevant topics (with an unavoidable personal bias) and give some key references.

One of these themes is *robustness*, that was initially considered in the Bayesian literature mainly in relation to the choice of the prior. Instead of considering a single prior, classes of priors were taken into account, analysing the differences induced on the inferences. Beyond parametric classes, attention was drawn also to nonparametric or to partially nonparametric classes, as the class of monotone distributions, of symmetric distributions, or contaminated distributions, quantile classes and so on (for reviews see Berger *et al* (1996), and Ríos Insua and Ruggeri (2000)) This rich literature allowed to move from mathematical convenience to much more realistic formulations of prior uncertainty. The proposal of interactive procedures (as in Liseo, Petrella and Salinetti, 1996) was a further step in this direction.

Another topic inherited by the frequentist statistic is the issue of *model testing and selection*. In a controversial paper Box (1980a, 1980b) claimed that the Bayesian analysis is fully adequate within a given model but is not useful for model criticism. His proposal for model criticism is based on the prior predictive distribution and has a clear frequentist flavour, together with an analogy with the classical *p*-value. This proposal suggested many developments in different directions. From one hand, the technique of *p*-values has been revisited, focussing initially on a criticism of the traditional Fisher theory of significance (a seminal paper is Berger,1986) and then on new concepts of Bayesian *p*-values where the problem is extended to the case of composite hypotheses, and then to model criticism (Bayarri and Berger, 2000). When the goal is to choose one model many authors suggest an explicit decision setting; the list includes San Martini and Spezzaferri (1984), Key, Pericchi and Smith (1999), Walker, Gutierrez-Peña and Muliere (2001), Barbieri and Berger (2004). The most natural Bayes approach to compare many models, when one is considered "true" (the so called M-closed setup), is however to attach probabilities to every model, in order to account for model uncertainty, and proceed with the standard probability rules. A general treatment of the *Bayesian model averaging* is Hoeting et al (1999). An alternative path is given by the use of *Bayes factors* for comparing models without assigning prior probabilities to the model themselves. This is for instance the proposal made by O'Hagan in the discussion of Box (1980b). As it is known, at least since Good (1950), given an observable result E, an hypothesis H_0 and its complement H_1, the Bayes factor for H_0 is

$$B=\text{prob}(E|H_0)/\ \text{prob}(E|H_1).$$

When H_0 and H_1 are simple, i.e. when they imply just one sampling distribution for the results, the Bayes factor coincides with the likelihood ratio. Otherwise, B also depends on the prior, though not on the probabilities of the hypotheses involved. For general treatments refer to Kass and Raftery (1995) and Berger (1999). The use of B allows then an analysis more modelled by experimental evidence than by prior information. When models are put instead of hypotheses in the formula, it may be desirable to assign improper priors to the parameters of each model. This however produce indeterminate expression unless very special procedures are used (Consonni and Veronese, 1991). A general solution is resorting to the so called *partial Bayes factors*, where the sample is split in order to use a training sample to produce a proper prior. Then we get an *intrinsic* Bayes factor (Berger and Pericchi, 1996), after averaging over all the possible training samples of a given size. Alternatively we can calculate a *fractional* Bayes factor (O'Hagan, 1995), which does not depend on the values of the training sample but only on its relative size. See also De Santis and Spezzaferri (1997), where connections with the issue of robustness are also explored. For the general topic of model selection, including also the assumption of a Model-open setting, that is when it is not assumed that the set of models contains the "true" model, see Racugno (1997), Lahiri (2001), Kadane and Lazar (2004) and Clyde and George (2004)..

As a last example, let us mention *nonparametric inference*. The mathematical modeling of the problem requires the use of probability measures on function spaces so that the practical understanding of the prior assumptions is quite demanding and a Bayesian treatment was delayed for a long time. Lindley (1972, p.66) wrote "this is a subject about which the Bayesian method is embarrasingly silent". This was true, at those times, although in a very short paper, many years before, de Finetti (1935) outlined the issue in a Bayesian framework (comments on this in Cifarelli and Regazzini, 1996). A turning point was the approach by Ferguson (1973) through the so-called Dirichlet process, which gave rise to many of the contemporary researches. Many different extensions, for instance the beta-Stacy process (Walker and Muliere, 1997) were proposed, together with some alternatives (see Lijoi and Prünster, 2010) .

The following comments deal instead with a selection of topics that the Bayesian approach can handle in a particularly easy way, while the adoption of other approaches makes things quite problematic. In these topics we include the elimination of *nuisance parameters*, the possibility of a direct treatment of *prediction problems*, the possibility of a complete treatment of the *design of experiments.*

Let us suppose that the parameter θ is a vector, say $\theta = (\lambda,\gamma)$ with $(\lambda,\gamma) \in (\Lambda,\Gamma)$, and that the inferential interest concerns only the component λ. The likelihood function depends of course on both the components, but, given the posterior distribution $\pi(\lambda, \gamma \mid x_{obs})$, we can get a posterior distribution for the parameter of interest alone by a simple marginalization, that is

$$\pi(\lambda|x_{obs}) = \int \pi(\lambda, \gamma \mid x_{obs})d\gamma.$$

For a recent review see Liseo (2006).

A problem of prediction is characterized by a statistical model $\{q(y|\theta), y\in\mathcal{Y}, \theta\in\Theta\}$, where the "true" parameter θ is the same of the statistical model of the observations and y is the future result which is the object of inference. Assuming the independence of X and Y (the present and future result, respectively) for a given θ, it is impossible to represent how the knowledge of X provides information on Y using only the sampling distributions of X and Y. On the contrary, the introduction of a prior distribution $\pi(\theta)$ for the parameter, allows us to calculate the marginal conditional distribution of Y given X

$$m(y|x_{obs}) = \int q(y|\theta)\pi(\theta|x_{obs})\mathrm{d}\theta$$

which is the most natural base for a prediction of the value y. A general reference for the topic, across the different approaches, is Geisser (1992).

In a problem of design of an experiment we have a class $\mathcal{E}$ of possible experiments, which can differ for instance for size of the sample, sequential stopping rule, choice of the controlled variables and so on. Any choice $e^*\in\mathcal{E}$ will get an evaluation depending in general on the result x and the parameter θ, both not known in advance. Under these conditions, general methods of eliminating θ without an integration with a prior distribution are unreasonable or unavailable, unless there are particular patterns as it may occur with linear models (Kiefer's theory). These situations are largely treated by Atkinson and Donev (1992) and were reformulated also in a Bayesian setting, see e.g. Smith and Verdinelli (1980) and Giovagnoli and Verdinelli (1983). A particular problem, of a great practical importance, is the determination of an optimal sample size. The diffusion of the Bayesian approach produced a lot of new methods; a starting point for the more recent researches in this field is the issue 2, 1997 of the journal *The Statistician*, entirely devoted to the subject. Among the most interesting features of the new Bayesian procedures there is the possibility of adopting a robust approach (De Santis, 2006), which is theoretically interesting because it establishes a link between distinct areas of research, but is at the same time clearly relevant from the perspective of applications. We remark at last that the choice of a design is primarily a decision problem, though the final goal could be an inferential statement. An excellent framework also for this particular problem was provided by a classic text in the Bayesian literature (Raiffa and Schlaifer, 1961). A review (always in a Bayesian setting) is Chaloner and Verdinelli (1995); a treatment largely dependent on Raiffa and Schlaifer (1961), with some updating, is chapter 8 in Piccinato (2009).

5. Relations with the decision-theoretic approach

The decision theoretic approach has many merits in clarifying the different approaches. After a reformulation of the inferential issues in a decision framework, it turns out clearly that the different inferential approaches optimize different aspects, so that the controversies could even disappear. One may ask whether the reformulation in decision-theoretic terms does not modifies or restrict the aims of inference. This is surely not true for the Neyman-Pearson-Wald school, because in that case the idea of optimization is intrinsic to the theory. It is well known that many times Neyman explained how *inductive reasoning* were often impossible since it involved events lacking a probability; *inductive behavior*, i.e. optimizing the long run performances of procedures, was instead the operational solution. For the Bayesian approach the situation is different: there are Bayesian scholars who prefer a complete model involving not only probabilities but also a specification of the available terminal acts and of the corresponding utilities/losses. But this is not mandatory, since a purely probabilistic analysis could also fit the situation. A proof is the large interest recently given to the methodology of Bayes factors, which provides conclusions which are less normative than those based on the probabilities. Problems with the use of Bayes factors were however pointed out: see Lavine and Schervish (1999) about their use as measures of evidence and Carota and Parmigiani (1996) about their use with nonparametric models.

If we explicitly adopt a complete decision setting, it is clear that the Bayesian approach aims at minimizing the expected loss of the terminal actions conditional on a specific result, while the frequentist approach aims at minimizing the risk of a procedure unconditionally on the result but conditionally on the unknown parameter. Wald (1951) proved that there is a strong connection between the two optimalities (the *complete class theorem*). Loosely speaking, the theorem shows that any reasonable decision is formally Bayesian and *vice versa*. In the Wald's approach prior probabilities are only weighting devices, but this result can be commented as a partial conciliation between the two approaches (see e.g. de Finetti, 1951, and Raiffa and Schlaifer, 1961 p.16). But the calculation of the risk requires an integration on the sample space and this is a violation of the likelihood principle. Indeed the equivalence between the extensive and the normal form of analysis assures that a complete class of decision functions will contain the optimal decision function in the Bayesian sense. This equivalence however does not extend to suboptima: it can happen that a decision functions d dominates (in terms of risk) another decision function d' but, for a particular result x, the terminal act $d(x)$ is dominated (in terms of loss) by the terminal act $d'(x)$. A numerical example of this phenomenon is provided in Piccinato (1980). A good long run performance is in itself a sensible characteristic but it should not be achieved by omitting to take into account the actual result, when available.

6. Final remarks

The present paper does not aim to compare the Bayesian and non-Bayesian approaches to statistical inference. It aims instead at pointing out the many alternatives which took place inside the Bayesian framework and developed in the years. We hold that all this is a richness of the approach and does not preclude its fundamental unitariety, based on the formal representation of the process of learning from experience. Limitations of space and knowledge prevent any hope of completeness. The wideness of the scene was clearly depicted by Berger (2000) eleven years ago, and of course this is always more true. In fact the development of simulation methods (MCMC and extensions) allowed to deal with complex models, with thousands of parameters, as it occurs in the modern applications in genomics and in environmental analysis (see e.g. Chen *et al*., 2010), while in the past mathematical tractability played a serious limiting role. In the next future, overviews of the Bayesian approach will surely focus much more on these aspects.

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An application of statistical matching techniques to produce a new microeconomic dataset on farming households' institutional sector in Italy

Edoardo Pizzoli, Benedetto Rocchi and Giuseppe Sacco

Abstract A new microeconomic database on farming households in Italy was created using statistical matching techniques. Information on total households' income and well-being gathered by the EU-SILC survey on living condition for Italy was attached to the observations included in the FBS database for Italy. The new dataset, still representative of agriculture as an industry, also allows a proper statistical representation and socio-economic characterization of farming households as an institutional sector.
The quality of the new microeconomic information was assessed analysing the distributive features of the current UE Common Agricultural Policy.

1 Introduction

In carrying out insightful analyses of distributive implications of alternative agricultural policy options, suitable microeconomic information on potential beneficiaries is needed. Two main characteristics seem to be relevant. First, the institutional sector of farming households needs to be properly placed within the economy-wide income distribution, observing the total household income (Unece et al., 2007); second, information should be available to classify households both using information on the farm (such as size, product typology, management form) and information on well-being of the household itself (such as composition, age, education, health).

The main sources of microeconomic information on the institutional sector of farming households, such as the Farm Business Survey (FBS) carried out by ISTAT or the European Farm Accountancy Data Network (FADN) , fail to comply with both these characteristics: their focus on technical aspects and the centrality given to income

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from farming makes these surveys suitable for analysis only within an industry (agricultural) perspective.

This paper aims to propose a possible solution to this information problem. In the next paragraph a description of data and methods used in the analysis will be proposed. A second paragraph will show some figures on distributive features of the family farming sector in Italy resulting from the new dataset.

2 Data and methods

A new microeconomic database on farming households in Italy was created using statistical matching techniques (D'Orazio et al., 2006). Information on total households' income and well-being gathered by the EU-SILC survey on living condition for Italy (ISTAT, 2010) was attached to the observations included in the FBS database for Italy. The new dataset, still representative of agriculture as an industry, also allows a proper statistical representation and socio-economic characterization of farming households as an institutional sector (Rocchi, 2010).This integrated archive was built by means of statistical matching techniques based on nonparametric imputation methods (hot-deck). More precisely in the realization of the matching between the two files was used the method of nearest-neighbour imputation where the proximity between two records is expressed by an appropriate distance function.

The distance function chosen for the matching procedure is the mixed distance (Gower distance), in order to take into account the presence of discrete variables between the matching variables. Given the value assumed for the observations *a* and *b* by *k* variables x_j available in both databases,

Gower : $\frac{1}{k}\sum_{j=1}^{k} c_j d_j(a,b)$

where:

for categorical variables: $c_j = 1$, $d_j(a,b)=0$ if $x_{a_j} = x_{b_j}$ and 1 otherwise;

for continuous variables: $c_j = 1/Range(x_j)$, $d_j(a,b) = \left| x_{a_j} - x_{b_j} \right|$

Different weights can be assigned to the matching variables. Both donor and recipient samples were stratified according to a space variable (region each observation belongs to). Two different regional stratifications were tested (5 and 20 regions corresponding to Nuts1 and Nuts2 classifications). To ensure a well balanced stratification both in the recipient and in the donor database the 5 regions stratification was finally adopted. The result of layering is shown in table 1.

The matching was achieved by placing the constraint that a record could not be donated more than three times; have also been considered as donors not only those with minimum distance but all those who had a distance $d(a,b)$ within the range:

$$d_{\min} - 0.01 \le d(a,b) \le d_{\min} + 0.01$$

where: $d(a,b)$ is the observed distance between the units *a* and *b* and $d_{\min}$ is the minimum distance observed .

The software package used was originally built for the production of an integrated archive for the social accounting matrix of Italian economy.A short documentation for the software is available at the site :
http://cenex-isad.istat.it/archivio/Technical_reports_and_documentation/software_on_statistical_matching/SAMWIN_manual.pdf

Table 1: Stratification of observations in the original datasets

Stratum	Freq. in recipient	Freq. in donor	Donor recipient ratio
1	1 552	4 973	3.20
2	2 607	4 990	1.91
3	1 951	4 950	2.54
4	2 876	4 400	1.53
5	872	1 669	1.91
Total	9 858	20 982	2.13

3 Some preliminary results

The matching procedure was based on a set of variables including: total household's income, number of household's members with at least some source of personal income, total income composition by source, prevalence of income from farming. The definition of the variables in the two datasets was harmonized. The 5 regions matching procedure was tested with two different sets of weights assigned to matching variables: the second test, carried out assigning a larger weight to total household income was retained

The potential interest of the matching experiment presented can be highlighted by the following figures estimated using the new dataset. In table 2 some figures on the distributive features of the family farming sector in Italy are displayed. Families are classified according to the prevalence of income from farming (agricultural vs. non agricultural) and by income quintile.

A good example of the potential utility of the new dataset is the percentage of Single Farm Payment from the Common Agricultural Policy, accruing to each household group (fourth column). The SFP, a direct transfer decoupled from the level of farm production, is the most important measure within the EU Common Agricultural Policy, in supporting farmers' income. Figures in table 2 reveals the existence of a distributive bias: the 7.7% of agricultural households included in the two highest quintiles gather more than 40% of SFP; furthermore for the richest agricultural households more than 15% of total income is represented by SFP.

Table 2: Distributive features of the Family Farming sector in Italy
Italy, 2007

Income Quintile	% Households	Average per capita equivalent income (€)	%SFP	SFP/total household income (%)	Well-being index

agricultural 1	26.1	3 214	25.1	31.9	0.4
agricultural 2	4.0	10 626	11.0	27.7	0.5
agricultural 3	3.2	15 077	12.3	24.3	0.6
agricultural 4	3.9	19 224	19.6	27.2	0.6
agricultural 5	3.8	39 427	20.7	15.3	0.8
non agricultural 1	33.7	4 789	5.1	3.1	0.4
non agricultural 2	10.3	10 647	2.3	2.0	0.5
non agricultural 3	6.3	14 780	1.0	0.9	0.6
non agricultural 4	4.7	19 559	1.6	1.5	0.7
non agricultural 5	3.9	40 823	1.3	0.8	0.8
Total	100.0	10 153	100.0	9.7	0.5
Q5/Q1 agr	0.1	12.3	0.8	0.5	1.8
Q5/Q1 non agr	0.1	8.5	0.3	0.3	1.9

The last column shows the average value of a composite well-being indicator including income level as well as information on housing conditions, education level, health status and social exclusion[1]. The index is based on new information from the SILC survey assigned to farmers included in the FBS sample through the matching procedure. The availability of well being indicators may represent a powerful tool in enhancing the targeting of agricultural policy.

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[1] The index is the geometric average of a set of class variables normalised with reference to the variation field; the index assumes a value included between 0 and 1; the aggregation through geometric averaging expresses a partial substitutability among different dimensions of well being (OECD, 2008)

Practical Reason in a World of Variability: Reflections on the Rise of Statistics

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Statistics (*statistica*, *Statistik*) arose as a practical, empirical science, concerned above all with questions of state and administration. That is how John Theodore Merz treated it in the chapter from his *History of European Thought* on "The Statistical View of Nature," written in the first decade of the twentieth century, just as the new mathematical field of statistics was coming into being. The word "probability," which by then was a well-established area of mathematics, had become prominent in the seventeenth century as an ideal of practical, non-demonstrative reasoning, reasoning that depended on empirical evidence and on the authority of the wise. From this standpoint, the history of statistical science appears as an effort, extending over several centuries, to make this kind of reasoning more rigorous on the basis of improved quantitative methods.

During the first part of the nineteenth century, statistics was chiefly a social science. Like other versions of the science of society in this period, it was closely allied with practical activities. Its object, the state or (increasingly) *society*, was a bit amorphous. The statistical approach meant, first of all, the collection, classification, and presentation of numbers. This science dealt with variability by arraying numbers on the grid of numerical tables, and considering whether variables associated with unequal numbers or frequencies could be understood as causes. This kind of analysis made little use of *statistical* variation, and in the extreme case, Quetelet's influential ideal of *l'homme moyen*, variability was dismissed as meaningless error. The regularities of these collective numbers provided reason to believe that there was such a thing as *society* that was more than a sum of individuals. The idea of variability as playing an active role in constructing or changing the world we owe above all to Darwinian biology. Through the work of statistical writers of the late nineteenth and early twentieth century, especially the English biometric tradition, whose most prominent figures were Francis Galton, Karl Pearson, and R. A. Fisher, this kind of statistics formed the basis for a new mathematical discipline. This *statistics* combines the analysis of variability in the form of natural variation with the management and reduction of uncertainty.

By now, the social science laboratory is becoming almost obligatory at serious universities, yet it is no more possible to contain a whole society or a political order within such a laboratory than to compress the Earth into a climatology model or a hydrogen bomb into a nuclear physics lab. Practitioners of social science have only occasionally called attention to this similarity between the object of their studies and those of natural science. Frédéric Le Play, the nineteenth-century French pioneer of social science case studies, was skeptical also of reductionist schemes in the sciences of nature. Trained as a mining engineer, he insisted that metallurgy, the practical science of mining, involved many subtle skills that could not be reduced to chemistry, and in the same way he rejected individualism and denied the possibility of general truths about society.[1] The more typical understanding of social science has preferred to compare it with experimental natural science, and to insist on a contrast because social science cannot construct an artificial world within the walls of the laboratory. And, so far as this goes, I cannot disagree.

This way of thinking, however, presupposes a particular understanding of social science objectivity. It is that knowledge should be made as something detached, in isolation from the world of law, charity, and administration, from poor relief and family policy and industrial regulation and investment decisions—from all the normal activities by which a society is governed. Before about 1890, this kind of objectivity was little known in social science, which did not reach consensus on the need of a "view from nowhere" for half a century after that. Meanwhile, government administrations, charity boards, urban reformers, institutions of policing and justice, and school authorities had been practicing an empirical form of social science and trying to enact it since the early nineteenth century. Here social science was engaged in the engineering of society, not as a byproduct of the knowledge attained, but simultaneously with the production of knowledge.

The meaning of "science," still quite loose in 1800, hardened over the course of the nineteenth century, and continued to become more restrictive in the early twentieth. "Social science" participated actively in this process, and was always in some danger of being cast out beyond the furthest frontier of the scientific domain. In English at least, this "science" was increasingly defined as the experimental or mathematical investigation of nature, and by extension to other studies employing similar methods. In German, the reign of natural science over scholarship was less absolute, so that any serious, systematic study of a topic could claim the respectability of *Wissenschaft*. French and Italian are, I think, somewhere between. But until almost 1900, there was little effort to set social science off from the civic and political processes of administration and reform. Municipal organizations that gathered information about workers and the poor, or national meetings of aristocrats, high civil servants, and members of parliamentary bodies all claimed the status of social science during the first seven or eight decades of the nineteenth century, and were not often challenged for their pretensions. Still, the form of social investigation that was most conscious of its methods was statistics. It was also by far the most fully institutionalized version of social science until quite late in the nineteenth century. This statistical social science was worked out in collaborations and dialogues between public officials such as census officers and social or economic groups such as trade unions, farm groups, chambers of commerce, and business leaders. I could give lots of examples, but will only mention an Italian one recently examined by Giovanni Favero involving the Italian statistical director of the end of the late nineteenth century Luigi Bodio and the leading wool industrialist Alessandro Rossi.[2]

Adolphe Quetelet, the most prominent advocate of statistics as a science during the mid-nineteenth century, wanted to make legislation an experimental art. Learning the principles of society and improving government could be one and the same program. The consequences of every act of legislation, in the form of changes in criminality or illegitimate births or popular instruction or trade, should be chronicled statistically, so that legislatures could determine if their measures had produced the desired consequences and determine whether to continue along the same lines. (This notion of legislation as a statistical, experimental science was revived in more recent times and is associated especially with the work of Donald Campbell.) Beginning in 1853, the International Congresses initiated by Quetelet took up another version of the statistical search for laws of society. This involved the standardization across countries of statistics, to facilitate quantitative comparison. Through the preparation of appropriate tables it should be possible to determine whether Catholic territories were less susceptible to suicide than Protestant ones, how urban birth rates compared with rural ones, and how popular instruction affected rates of burglary and murder. The plan was, however, impossible to implement. While the statistical directors who attended the Congresses might have been in a position to adopt standard procedures of counting, they certainly could not dictate the uniform laws, systems of policing and justice, school curricula and so on that would make the comparisons meaningful.

Another site of intense effort to make statistics comparable was statistical medicine, and especially the administration and treatment of the insane in asylums. These institutions expanded hugely over the course of the nineteenth century. That expansion seemed like a triumph of medical involvement and of state activity for the welfare of the poor and sick, but the unrelenting increase of the insane suggested also that treatment was failing. The institutions were becoming highly statistical by 1800, in part because they were required to report to the state and in part because they filled up with hundred and then thousands of people who could not be readily understood as reasonable individuals. Italy took a prominent role in the statistical study of insanity; I would mention Enrico Morselli in particular. A graduate student from my university, Daphne Rozenblatt, is in Bologna now researching some of these Italian alienists, while I have recently been studying American, British, and especially German efforts to find a reliable classification of the insane for the sake of the statistics. They were hoping, more and more, that a consistent statistics would enable them to benefit from the huge mass of experience on treating the mentally ill and to understand better the causes or perhaps to find therapies. They hoped in this way that the avalanche of insanity could be checked.

In the twentieth century, and in the postwar era, official measurement, especially of the economy came to be separated from academic social science, though econometric studies were almost completely dependent on government statistics. It was difficult even to introduce categories other than those recognized in the statistics. Economic measurement was more highly valued in the ostensibly less rational domain of public policy. Mary Morgan points out that while some economics amounts to ivory tower mathematics, important parts of the discipline have evolved in reciprocal interaction with the trends of modern economic and political history.[3] Alternative schemes of governance, such as economic planning (or engineering), the welfare state, Keynesian macroeconomic management, and neoliberal decentralization, have each been linked to distinctive forms of economic theory and of statistical information.[4] Even economics in its most liberal and rigorously analytical form has paradoxical ties with an interventionist political economy. As Michael Bernstein argues, the liberal economics of free markets proved itself in the United States in the "completely regulated and controlled economy of total war."[5]

Although the twentieth century was riven by ideological faults, the origins of economic measurement show striking interactions and intersections among hostile nations. And this is not because economic quantification, as a scientific activity, grew up independently of policy actions. I do not mean to minimize the differences among Soviet Communism, German fascism, and American capitalism. But in view of these differences, we have to be impressed by the adaptability of economic measurement practices. Early Soviet leaders, in pursuit of economic efficiency, adopted the language and tools of Frederick Winslow Taylor's scientific management, along with an almost American faith in technocratic rule. "Communism is Soviet power plus the electrification of the whole country," proclaimed Lenin. Reacting instantly, the American economist and social critic Thorstein Veblen contrasted the indispensable technical competence of engineers with the terrible economic damage—he called it "sabotage"—inflicted by "captains of industry," especially financiers, who understood so little of the technological foundations of a modern economy. He expressed sympathy for the Bolshevik project to install technical competence in place of the vagaries of the price system, but insisted that if a revolution were in store at home, it must be led by the technicians and not by mere laborers.[6] Taylor himself saw scientific management as a way of reconciling workers to more effective work practices imposed from above, a consolidation rather than dilution of managerial control. This would, however, place a premium on technical skills over customary business practices.

Given all this fluidity in the uses of economic calculation, it is perhaps not surprising that the modern idea of "the economy" derives as much from managerial and bureaucratic intervention as from any awareness of a higher-order and partly self-regulating entity, produced spontaneously by uncoordinated human actions and by Adam Smith's invisible hand.[7] At the heart of this notion of the economy is a kind of reversal. In Marxian terms, it might be seen as a fetishization by economists and expert functionaries of what they themselves did much to create. Such reversals appear quite typical of modern economics and the modern economy, once we view them historically and culturally.

Statistical investigation gave a new specificity and concreteness to the notion of "the economy." Measurement of national production, pursued in a desultory way from the eighteenth century, became increasingly urgent after the First World War. Even before 1929, the study of economic cycles had become a fundamental problem for economics. E. M. Burns (also of Columbia University), wrote just months before the stock market crash of the "movement of those [statistical] series which are taken to characterize the economy."[8] The campaign gained momentum during the depression of the 1930s with attempts to stimulate a renewal of economic activity and then to reconfigure productive capacity in preparation for war at the end of the decade. German *Nationalökonomie* became much more interventionist during the interwar period, attending with increasing care to the circulation of goods and commodities. These were measured and presented in charts illustrating the circular flow of materials. Such charts and numbers were championed by Ernst Wagemann, a pioneering German economist and statistician who developed them in an effort to understand business cycles and deployed them during the Depression in an effort at economic planning. Later these charts guided the German economic mobilization for war, though the pervasiveness of bureaucratic conflict and the Herculean challenge to be nimble enough with the statistics to keep up with rapidly changing circumstances was beyond their capacity. Nevertheless, their charts did provide specific, almost tangible representations of "the economy," even if this economy continued to defy effective management.[9]

France, Britain, and the United States also followed a trajectory marked by fitful attempts to direct the economy during the First World War, the resumption of this effort in a different mode during the Depression, then a strong shift toward a command economy during the Second World War. The effort to neutralize cycles of abundance and depression is associated especially with John Maynard Keynes, but for our purposes the career of Wassily Leontief is still more illuminating. Leontief is known for his input-output matrixes, which won him one of the first Nobel awards in economics in 1973 for its contribution to economic planning and forecasting. He got his start as a commentator on national economic balances in the Soviet Union, then emigrated to Germany, taking his Ph.D. in Berlin in 1928 and working for several years at the Institute of World Economics of the University of Kiel. When he arrived in the United States and took positions at Harvard University and the National Bureau of Economic Research, he was familiar with Soviet economic planning and thoroughly steeped in Wagemann's methods of representing and measuring the circular flow of economic activity. His work contributed to economic planning in the United States and in much of the world, and again, by measuring the economy, helped to solidify that nebulous entity.

Perhaps the most central tool in making "the economy" visible was the measurement of "national income." Like so much work in the statistical description of economic life, this effort was closely allied with economic management, and involved government along with university economics. Richard Stone, the great pioneer of national income accounting, had decided during the Depression to study economics at Cambridge, and he worked there with Keynes, but he did not pursue postgraduate study, nor did he attain the sort of skill in mathematics or mathematical statistics that was becoming more and more common among elite economists. He was recognized by the profession with a Nobel award, which demonstrates their awareness of the importance of national income accounting for the field, but he, even more than Leontiev, was an outlier among the economics Nobelists. Stone was, after all, first of all a government statistician, though he also maintained a university affiliation at Cambridge, and his methods developed in response to the practical demands of British wartime economic mobilization. In the course of this work he traveled to Ottawa and Washington to coordinate this statistical project with Britain's Western allies. They were already at work on similar problems, and since income measurement was not yet encrusted in the various national bureaucratic and legal structures, it was possible to reach agreement on certain fundamentals. Although the Dutch and the French, for example, developed their own versions of national accounting, an international system of public accounts emerged at the same time, and this has been very important for their visibility.[10]

What, for example, could be more central to *the economy* of a nation than its gross national product (GNP), or gross domestic product (GDP)? These were concocted by the Organisation for European Economic Cooperation (OEEC), predecessor of the Organization for Economic Cooperation and Development (OECD). The OEEC was created in 1948, still in the shadow of World War II, to prepare a European recovery program. In one more historical irony, this system of economic measurement and planning was strongly supported by the United States, which at other moments has been strident in support of free markets, as a condition for the receipt of Marshall Plan aid. The Americans, not wanting to pour their dollars down a sink hole, insisted on rational allocation and accountability. The Marshall Plan illustrates the links between measurement of the economy and "economic development," which, as Timothy Mitchell shows in his work on Egypt, were in place in colonial situations decades prior to Stone's system of national accounting. Since about 1950, this aspect of economic calculation has been particularly significant for relations between the industrialized "first world" and the more impoverished "third." The OECD has remained a preeminent sponsor of economic and social measurement, generally in the cause of promoting economic growth. Now, more and more, it is pursuing a more diverse set of measures than just GDP, and I am aware that Italian statisticians, notably Enrico Giovannini, are taking a leading role in this effort. [11]

Economic calculation and measurement, similarly, do not merely describe the world, but help to remake it. Statistical measurement and cost-benefit analysis stand for and ideal of science that, by making explicit, promotes calculation as the replacement for personal trust, and opens up the economic world to administrative oversight and regulation.[12] Free market and state, by this accounting, are not simply in opposition, but have been refashioned, each by the other, under the watchful gaze of economic science, into uneasy allies. This impulse of economics, often called neo-liberalism, is much discussed now, and it seems to reduce so much of social action to the maximizing behavior of self-interested individuals. Yet it is very much a statistical project, having generated, as Alain Desrosières points out, a distinctively neo-liberal form of public statistics, and statistics thus continues to have a key role in the pursuit of practical reason.

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[7] Timothy Mitchell, *The Rule of Experts: Egypt, Techno-Politics, Modernity* (Berkeley: University of California Press, 2002), chap. 3; for a longer view: Margaret Schabas, *The Natural Origins of Economics* (Chicago: University of Chicago Press, 2005), chap. 1.
[8] E. M. Burns, “Statistics and Economic Forecasting,” *Journal of the American Statistical Association*, 24 (1929), 152-163, p. 154. On statistical study of economic cycles, see Mary Morgan, *The History of Econometric Ideas* (Cambridge: Cambridge University Press, 1990)
[9] Adam Tooze, *Statistics and the German State, 1900-1945: The Making of Modern Economic Knowledge* (Cambridge: Cambridge University Press, 2001), esp. p. 151.
[10] Richard Stone autobiography in Richard Odelberg, ed., *Les prix Nobel /The Nobel Prizes, 1984* (Stockholm: Nobel Foundation, 1984); André Vanoli, *A History of National Accounting*, trans. M. P. Libreros and G. H. Partmann (Amsterdam: Ios Press, 2005)
[11] Morgan, “Economics,” in *Cambridge History*, 301-302; Mitchell, *Rule of Experts*.
[12] Compare James Scott, *Seeing Like a State* (New Haven: Yale University Press, 1998)

The Italianization of statistics: interpreting Gini's critique of inference

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1. Introduction

Corrado Gini's famous 1939 lecture on *The Dangers of Statistics* is generally considered as a landmark in the history of Italian statistics. Delivered at the outset of the *Società italiana di statistica*'s (SIS) first meeting, it became the launching salvo of a full-blown assault against the inferential methods characteristic of "Anglo-Saxon" statistics. Gini, who had devoted considerable energy to the concept of probability in his very early years as a statistician (1907-1911), came back to his "first love" after nearly three decades largely spent on descriptive statistics, social science, and state statistics. Over the course of next six or seven years, Gini would devote some fifteen more papers – a number of which were presented at SIS meetings – to an elaborate "critical review of the foundation of statistics".[1] Especially criticized by Gini were the significance tests, whose use had become common since the publication of R. A. Fisher's 1932 *Statistical Methods for Research Workers* – in this regard, Gini was the unrecognized forefather of a critical tradition that is periodically reborn[2] – as well as the theory of confidence intervals developed by J. Neyman and E. Pearson shortly after. This effort on the part of Gini has been interpreted up to now mainly in view of contemporary

[1] Gini would come back regularly on this theme until his death in 1965. But his writings up to the 1946 "On the logical bases and gnosiological importance of the statistical method" (presented as a summary of the views he had developed during "the period of isolation, imposed by the war") form a coherent set in many respects, as we shall see.
[2] Significant landmarks in this regard came from disciplines where significance tests were largely used, namely sociology Morrison, Denton, and Henkel, 1970), psychology (Harlow, Mulaik, and Steiger, 1997), and, more recently, economics (Ziliak and McCloskey, 2008).

theoretical debates about probability and inference and of his own early contributions in this regard (Forcina, 1987; Costantino, 1994; Giorgi, 2005). Gini's 1939-1946 critique of Fisher's fiducial methods and of the Neyman-Pearson approach to hypothesis testing approach and the conception of probability on which it rested have been generally characterized by Italian statisticians as "prepar(ing) the ground in Italy for the re-birth of Bayesian theories" (Herzel and Leti, 1978: 26), as "empirical Bayesian" (Forcina, 1982: 65) and, more recently, as "strictly objective Bayesian" (Frosini, 2005: 435).

The intent of the present paper is to move forward from this kind of "internal" interpretation of statistics, which envisions the history of the discipline as the rational reconstruction of a set of concepts, techniques and devices, to a more sociologically grounded type of analysis. However commendable and precious may be the above-mentioned contributions – and ample use will be made here of the insights they provide –, they do take for granted a degree of autonomy that practitioners of a scientific discipline have struggled hard to develop and maintain. It is for instance obvious that the definition of a statistician in Italy, in other words the scope of the discipline, had evolved significantly between the period under consideration here and the moment – late 1970s, early 1980s – when statisticians of a later generation published their assessments of Gini's views. This had to do largely with the progressive demarcation between statistical methodology, on the one hand, and the empirical subject matters these methods could be applied to.[3] Should we therefore interpret specific episodes in terms of their results as embodied in the present state of the discipline (i.e. "all the past being supposedly summarized in the next-to-last step of science and in the leap that allowed passing to the last state" [Desrosières, 2008: 30]), or in terms of a future that was still to come and thus opened to more than one single path? In our view, the concept of statistics as an intellectual or scientific "field" (Ringer, 1990; Bourdieu, 1997), which may be defined as a structured and multidimensional set of positions governed by specific criteria of legitimacy, offers an appropriate framework for taking into account how this autonomy is always intertwined with, sometimes enhanced and at other times hindered by, the evolving environment in which it operates. The institutional – by contrast with the narrowly scientific or conceptual – development of Italian statistics, domestic and transnational rivalries among statisticians, the specific historical and political

[3] Clear awareness of this can be found in Frosini, 1989: 207-210, who quotes S. Vianelli, N. Federici, V. Castellano and Gini as they put forward a comprehensive vision of statistics that did not acknowledge – as present-day statisticians do – the distinction between formalized models and empirical subject-matters.

circumstances, will all be taken into account here to provide a variety of contexts against which to interpret the significance of Gini's 1939-1946 contributions on inference. In the 1946 paper in which he sought to recapitulate the results of his wartime writings on the issue, Gini argued that his reconsideration of "the logical bases and gnosiological importance of the statistical method" stemmed from some three decades spent, on the one hand, on "organically developing statistical theory" and, on the other hand, on "testing its suitability and usefulness by application to the most varied scientific fields" (1946 [2001]: 350). We may add that, besides being a theoretical as well as a practical statistician, Gini was also a scientific entrepreneur, an unorthodox economic theoretician, as well as an idiosyncratic intellectual of Fascism: as we shall see, all these identities do fashion, at one degree or another, the views about probability and inference he put forward from 1939 on.

2. Statistics, scientific nationalism and international rivalries

Throughout his intellectual life, Gini was eager to insist on the originality of Italian contributions to the methodology of statistics. In a lecture delivered before the London School of Economics (Gini, 1926) as well as in an article published soon after his death in the *Journal of the Royal Statistical Society* (Gini, 1965), he provided exhaustive assessments of Italian statisticians' achievements in this regard. In both papers, Gini stressed the contrast between, on the one hand, the "Italian School of Statistics", which was focused on the description of frequency distributions, with special attention to the theory of averages, to variability and concentration, and to the problems of survey design, and, on the other hand, "Anglo-Saxon" statistics, which were mostly concerned with sampling, statistical significance, and the management of error. This contrast, or at least a degree of genuine originality of the part of Italian statisticians, was somewhat acknowledged by the other side, as shown by the presence of an appendix on Italian methodological contributions in a number of editions of a famous English statistical textbook of that era (Yule and Kendall, 1937; 1940; 1944; 1947) and, more significantly, the inclusion of more than sixty asterisked entries prepared by Gini in the first four editions of the authoritative *Dictionary of Statistical Terms* (Kendall and Buckland, 1957; 1960; 1976; 1982). To be sure, the "Italian School" as defined in all these settings offered a selective and skewed subset of the work accomplished by the whole community of Italian statisticians. Of the 78 items appearing in the Yule and Kendall appendix, no less 48 bore Gini's name, while 7 were by G. Pietra, 4 each by F. P. Cantelli and L. Galvani, and the rest were divided among 14 authors mentioned once or twice. And, of course, the dictionary entries dealt exclusively with work carried by Gini himself, the sole Italian who had taken part in this undertaking. We will return below on what this "sectarianism" implied in the context of the Italian statistical field.

But scientific nationalism was clearly on the rise in the late 1930s. The meeting that was held on the occasion of the centennial of the *Società Italiana per il Progresso delle Scienze* (SIPS) in October 11-15, 1939 (two days after the SIS's foundational meeting and some 40 days after Germany's invasion of Poland and the subsequent declaration of war by Britain and France) provided indeed a platform from which Italy's scientific achievements could be celebrated. During the session that was devoted to statistics, Gini and a number of statisticians who were close to him delivered an overall assessment of the state of the discipline, dealing successively with probability calculus (P. Medolaghi), methodology (G. Pietra), biometry (F. Paglino), demography (P. Fortunati) and economic statistics (G. Ferrari and A. De Polzer). In all five areas, the reports documented early Italian contributions and work that had been accomplished over time and insisted on Italy's intellectual and scientific independence in a manner that was consonant with the normative constraints defined by the regime-defined ideal of "autarchy". Gini's own report, which sought to establish the "international position" of Italian statistics, was written from an explicitly national comparative standpoint. It envisioned the issue almost as a sporting contest, with Italy and England standing *ex aequo* with regard to methodology (albeit mostly – and thus somewhat ungentlemanly – because of the English language being better understood around the world than Italian); in demography, Italy clearly led the way, while England kept the upper edge in biometry (but Italy maintained here "a very honorable position on the whole"); there was clear American supremacy in the field of economic statistics - yet, this was from a "quantitative point of view", since, "in the narrowly scientific domain, the contribution of Italian statistics (was) not inferior to that of any other nation" (1939b, 245-252, *passim*) .

In fact, besides the chronological coincidence, this nationalistic, if not chauvinistic, bias and, more importantly, the context of the war may be connected in a number of respects to the 1939 lecture on the dangers of statistics and to the string of papers that followed it. First, as Forcina has already noted, it is obvious that Gini did not have a complete grasp of the positions he criticized and, notably, that he "did not appreciate the difference between the Fisher and Neyman-Pearson approaches" (1982: 67). In his 1945-1946 recapitulative paper, Gini imputed this mistake to difficulties of communication during the war, notably to the fact that he could not take into account a paper published by Neyman in 1941 (Gini, [1945-1946] 2001: 380; in the printed version of his 1943 lecture on significance tests, such problems are already mentioned). However, Frosini shows that Gini's error reveals in fact insufficient familiarity with or misunderstanding of earlier papers by Neyman and Fisher in which this difference was clearly spelled out (1982; *ibid.*). Obviously, the war could not but accentuate the scientific "autarchy" that was encouraged already before it started.[4] The fact that the two statisticians who were invited to the 1943 meeting of the SIS in order to defend the value of significance tests, M. P. Geppert and H. Von Schelling, were Germans also illustrates limitations to cross-national scientific exchange imposed by circumstances; Gini was able to dismiss these opponents somewhat easily and the problem was therefore not "discussed with full competence" (*ibid.*). Finally, given the fact that Gini's "critical review of the foundation of statistics" represented a considerable investment of energy as well a significant part of his wartime output (sixteen contributions if we include his 1945-1946 paper), it is interesting to compare it with the rest of his (considerable) intellectual output during that period. Numerous topics sustained Gini's attention between 1939 and 1945, but three groupings stand out. Eight papers, usually short and delivered most of them on the occasion of SIS meetings, dealt with various aspects of statistical methodology (such as transvariation, correlation, or interpolation). Some six papers presented results from Gini's bio-demographical research on primitive populations and were published in *Genus*. But the most consistent set of papers he published during the war dealt precisely with the conflict in its various aspects. The titles of these nine papers, all consistent and some of them published in journals of a more ideological than scientific character (*Razza e civiltà*, *Archivio di Studi Corporativi*), are quite explicit with regard to the war and its opposing camps: "*La lotta attuale tra popoli conservatori e popoli espansionisti e l'evoluzione organica delle Nazioni*", "*La crisi della borgesia e il compito dei regimi totalitari*", "*Autarchia e complessi economici supernazionali*", "*Aspetti demografici della Guerra*", "*La politica demografica delle democrazie*", etc. The parallel is in fact striking between this series of writings, which may be described as Gini's own intellectual contribution to the Nazi-Fascist war effort, and that directed against the Anglo-Saxon inferential methods, as if the latter was the theoretical sublimation of the former. Indeed, Gini later considered that the intellectual victory of the Anglo-Saxon school and the "indiscriminate" and "blind" use of "mathematics" by "a large number of young statisticians" in Italy

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[4] For an overview of the Fisher-Neyman dispute that may lead to temper Frosini's judgment, see Howie, 2002: 176-180. Howie's monograph is largely dedicated to the debate between Fisher and H. Jeffreys that occurred between 1932 and 1934 and one may consider as significant of this "autarchy" the fact that it had no echo in Gini's writings of the 1939-1946, besides a passing reference to Jeffrey's 1939 *Theory of Probability* in Gini, 1943 (2001): 336, n. 50.

resulted from the outcome of the war: in other words, Science followed the flag! (Gini, 1950 [2001]: 422).

3. Domestic rivalries: two societies for a discipline

The precise timing of Gini's critique of inference also results in part of the changes undergone within Italian statistics in the late 1930s, as regards to the power and resources various individuals or groups within the field could command. The quasi-simultaneous creation, in late 1938 and early 1939, of two rival statistical bodies, with distinctive membership and orientation, was the awkward outcome of the inconclusive debate held in 1935 in the pages of the *Barometro economico italiano* about the wisdom of creating an Italian society of statistics. Up to then, statisticians and economists were regrouped as a section of the SIPS and meetings were held nearly each year since the SIPS's revival in 1907, but no national body of statisticians on the model of the British Royal Statistical Society or of the American Statistical Association existed in the peninsula. Interestingly, skepticism about the desirability and feasibility of such an enterprise was expressed by Gini himself – he was after all very present at SIPS meetings – as well as by some statisticians – such as V. Dore, D. De Castro and L. Livi – who feared that such a body may be subject to "monopoly" or "domination" by certain persons, groups or schools, a rather transparent allusion to Gini's position and character. In early 1937, L. Livi launched the *Comitato di consulenza per gli studi sulla popolazione* (CCSP), which immediately became Italy's representative before the International Union for the Scientific Study of Population (IUSSP). In this, it simply took the place left empty following the clash between the IUSSP and Gini's own *Comitato italiano per lo studio dei problemi della popolazione* (CISP) over the scientific independence of the 1931 International Congress on Population held in Rome under the latter's chairmanship. The CCSP nucleus was composed of some thirty statisticians, demographers and economists, none of which was closely associated to Gini. Its legitimacy was unquestionable, since six (and very soon nine) of Italy's seventeen *ordinari di statistica*, seven members of the *Consiglio Superiore di Statistica* (CSS), as well as the two top officers of the *Istituto Centrale di Statistica* (ISTAT), President F. Savorgnan and Director General A. Molinari, belonged to it. In November 1938, following its third meeting, the CCSP became the *Società italiana di demografia e statistica* (SIDS): membership quadrupled and other eminent figures, such as R. Benini, P. Jannaccone, and A. de Stefani, joined the ranks. In its statutes and in conformity with its name, the

SIDS insisted on its dedication to demographic and statistical studies alike. Its main initiator, L. Livi, had by that time risen to unquestioned scientific eminence as a demographer and, as an intellectual entrepreneur, had emerged from his Florence power base as the most obvious contender to Gini's up to then unchallenged position in the field. The SIDS would soon move closer to the Fascist regime's priorities, with Livi and Savorgnan joining the *Consiglio Superiore della demografia e della razza*, an advisory body created in September 1938 in the context of the enactment of the racial laws.[5] In 1939, Livi would claim that the creation of the SIDS had been "supported with sympathy" by the *Direzione generale della demografia e dela razza*, soon to be known under the familiar name of *Demorazza*, and had been "entrusted" with conducting "specific enquiries" on its behalf (Società italiana di demografia e statistica, 1940: 11).

The creation of the *Società Italiana di Statistica* (SIS) barely two months after that of the SIDS, clearly appears as a direct response of statisticians close to Gini, such as G. Pietra, M. Boldrini, or P. Fortunati. Interestingly enough, Gini's name did not appear on the list of the SIS's original promoters; all the more spectacular was his entering the stage as the keynote speaker of its inaugural session in October 1939. In a regime where organic unity was the proclaimed norm, especially after the totalitarian turn that had been taken in the second half of the 1930s, the creation of a second statistical society needed a rationale of its own. This was provided by the insistence, expressed in article 1 of the SIS statutes, on the development of "scientific research in the field of statistical disciplines with special attention to statistical methodology" (Pietra, 1939). By comparison, the SIDS statutes, in their own article 1, defined "the progress of demographic and statistical studies, with special attention to the quantitative and qualitative progress of the Italian population" (Società italiana di demografia e statistica, 1939) as the end it pursued. The demarcation was clearly therefore spelled out. The SIS was dedicated to *scientific research* by contrast with the vagueness character of *studies*. Statistics was its single overarching object and methodology, rather than an empirical issue (population), provided the specific focus.

Moreover, notwithstanding the loyalty oath to the King and Fascist regime article 7 imposed upon its president and vice-president, the SIS remained at arm's length of official bodies such as ISTAT or *Demorazza*. In his earlier intervention on the opportunity of statistical society, Gini had

[5] As a result, five of the CCSP's founding members (G. Arias, R. Bachi, R. Dalla Volta, G. Del Vecchio and S. Somogyi) would lose their academic position.

considered such a formal independence to be a necessity if the production of such bodies were to be criticized freely (1935). And whereas meetings of the SIDS were often concerned with applications or policy issues (i.e. labor, insurance, economic and demographic of the Mediterranean area, etc.), Gini's highly theoretical inaugural lecture, by contrast, set the course for the SIS, where more than a third of all papers (55 out of 145) presented on the occasion of the seven meetings held between 1939 and 1943 dealt with methodological topics. At the same time, SIS meetings were also the place where the architectonic definition of statistics, i.e. statistics as a set of methods but also capable of making significant contributions to the subject matters to which these methods were applied, was reasserted, as shown by the vastly diverse empirical contributions presented on these occasions (Società Italiana di Statistica, 1964). In other words, statistics had a disciplinary existence of its own, while social sciences were somewhat subordinated to statistical methods, a point that would incidentally be contested by Livi with regard to demography (1941a, 2-3). Besides establishing the singularity of the Italian school's outlook with regard to mainstream Anglo-Saxon statistics, Gini's *I pericoli della statistica* and the critique of statistical inference that it contained also acted as a demarcation line in a disciplinary field where eminence, prestige and the access to resources was in constant flux.

4. Sampling and skepticism

Gini's criticism of inference should also be interpreted in light of his more general scientific ambitions, whose range largely outreached the frontiers of statistical theory, and of his considerable experience as a "practical" statistician, both before and during his tenure at ISTAT. In fact, given his combined position as Italy's foremost academic statistician as well as the country's top official statistician (from 1926 to 1932), Gini was able to embody for a while the two meanings carried by the word *statistics*: namely, statistics as a "tool for government", that is data collected according to specific protocols of inquiry in order to provide decision-makers with adequate information, and statistics as a "tool for proof", i.e. mathematical tools used for processing and analyzing large series of data (Desrosières, 2008: 59). These two meanings were closely blended in a practical/theoretical debate in which Gini was fully involved during the 1920s and 1930s, i.e. that on the so-called "representative method".

The practical dimension of the theoretical disagreement between Gini and those whose views he criticized made a discreet appearance in two footnotes at the end of his 1943 paper on significance tests (reprinted as Gini, 1943 [2001]: 339 and 346). There, Gini refers to J. Neyman's 1934 paper in *The Journal of the Royal Statistical Society* as well to a lecture delivered by the same author at the Graduate School of the United States Department of Agriculture in 1937. The former was devoted to the respective merits of the methods of stratified sampling and of purposive selection and is retrospectively considered as a watershed in the history of sampling and inference. It somewhat immortalized an experiment conducted by Gini and Galvani in the late 1920s and showed that the method they had chosen could not but lead to unsatisfactory results (Neyman, 1934). In his 1937 lecture, Neyman was more caustic, stating that Gini-Galvani had had the merit of providing "a good example of how not to sample human populations". (Neyman, 1937 [1952]: 105). To understand these comments, one has to go back to the work of an International Institute of Statistics' commission, of which Gini was one of six members, and whose report on the issue of the "representative method" in statistics was presented in 1925. The Jensen report, at it became known, presented two methods as equally valid. One was that of random selection, defined as that according to which units of a sample should be chosen according to a process that insured all units of the population had an equal chance of being selected. The other was that of purposive selection, in which a valid sample was defined as one whose units presented characteristics that were similar to those of the population from which they came; representativeness of such a sample could be measured for instance by comparing its dispersion with that of the population (Jensen, 1925). Gini's name became closely associated with the method of purposive selection following his attempt, together with L. Galvani, at constructing such a sample on the basis of the forms compiled on the occasion of the 1921 Italian census. Gini and Galvani were intent on saving a subset of these forms from threatened destruction for the purpose of conducting further analysis of the census results. They chose 29 of the 216 census districts on the basis that, in these cases, the averages of seven major variables did not differ much from their value for Italy as a whole. They soon discovered, however, that when they looked at other variables, or at values other than the mean for their original variables, the 29 districts they had chosen were not representative anymore. This led Gini and Galvani to draw a distinction between "relative", i.e. when sample and population coincided in one or more aspects or variables, and "absolute" representativeness, which was deemed impossible.

Such skepticism, which led the authors to a distrust of sampling as a cheap and satisfactory substitute to exhaustive and costly inquiries, was at that time not atypical among official statisticians, i.e. those who embodied the "tool for government" dimension of statistics: exhaustive inquiries were still the ideal; the national census, with "many individuals but few variables", was the grand undertaking, and the monographic method, with "few individuals but many variables", remained popular, notably in Italy.[6] Given "the primitive nature of the data at our disposal" and the fact that it "may be too rough to allow of the application of exquisite methods", given also the limited means at their disposition, Gini thought it "more useful" to spend more time increasing the quantity of data (1926: 706-707). During the discussion about economic barometers that was held at ISTAT in February 1928 under Gini's chairmanship, R. Bachi also mentioned the lack of data and its poor quality as an obstacle to any satisfying description of the economic cycle, a view shared by most other speakers (Ancona, 1928: 5-6). As for the more ambitious goal sometimes upheld by proponents of economic barometers, that of eliminating or at least mitigating the economic cycle, Gini was adamant: far from achieving this purpose, it could on the contrary intensify its movements (ibid., 10; see also Gini, 1935b; 576-577). Even after the war, Gini promoted "accuracy" and "completeness" of data as an ideal against which "the indiscriminate use of sampling" was presented as a dangerous fashion (Gini, 1950 [2001]: 424-425).

Against the kind of views held by Gini, pioneers of survey sampling, such as M. Hansen and W. E. Deming in the United States, argued that it could yield more accurate results than enumeration, i.e. data of a better quality, as far as control over all phases of inquiry became easier and less costly. At the same time, they felt confident because sampling of economic data was seen as an element in a chain that brought together areas that had been up to then envisioned separately, notably agricultural research, industrial quality control and, especially on the aftermath of the war, macroeconomic management.[7] But industrial quality control did not penetrate Italy until the 1950s,[8] and, far from being confident in any form of economic finetuning, Gini was in this regard radically skeptical, as we have seen.

[6] This characterization of the census and monographic methods is borrowed from Desrosières, 2008 : 110.

[7] A remarkable example of this confidence in sampling as a tool for macroeconomic management is provided in Keyfitz, 1945. N. Keyfitz, later known as a demographer, was at that time mathematical adviser at Canada's Dominion Bureau of Statistics, where he introduced sampling methods.

[8] The *Associazione Italiana per il Controllo della Qualità* was created in 1955. Among its founding members was F. Brambilla, a regular participant of SIS meetings since 1939.

5. Conclusion

Gini's wartime criticism of "Anglo-Saxon" statistical inferential methods stands as a significant episode of his own intellectual trajectory as well as of the history of Italian statistics. From the perspective of statistics as a scientific discipline, it can be interpreted as a "contribution to the logical bases of inference" and as a one-man struggle against the then-dominant trend (Herzel and Leti, 1977: 6). From the perspective of statistics as a field, it takes a number of other meanings that in their turn impact upon our understanding of the discipline. It is for instance obvious that methodological nationalism was very much alive in the 1930s and acted as a prism that could both magnify and obscure various aspects. Differences between Italian and Anglo-Saxon statistics were undoubtedly important, but it is clear in retrospect that, on the Anglo-Saxon side, a number of high-profile internal disputes (Fisher/Jeffreys, Neyman/Fisher) had occurred that were highly relevant to Gini's points and were yet largely ignored by him. The intellectual autarchy that resulted from the regime's normative constraints seems to have played much more than difficulties of communication due to the war in this regard. The chronological coincidence between the creation of a statistical society primarily devoted to methodological studies and the launching of a string of contributions that would provide it with a singular "line of attack" both on the national and on the international statistical scene is also remarkable: not only was the SIS more "theoretical", and therefore more comprehensive, than the SIDS, but it was also in a sense more Italian. Finally, Gini's critical assault on Anglo-Saxon inferential methods also reflects the relation of Italian statistics to Italian society: whereas the success met by the Fisher and Neyman approaches in Britain and the United States surely had to do with the state of social sciences in these countries, the development of industrial quality control and the adoption of survey sampling for pragmatic motives, none of these conditions were present in Italy at that time.

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The changed meaning of “migrant” during the fascist regime and the difficult comparability of the official statistics of Italian foreign migration over time

Sandro Rinauro

The actual number of Italians who emigrated abroad during the century of Italian mass migration (1876-1976) is still largely unknown, because of four principal reasons: 1) the large size of clandestine migration; 2) the difficulty of border and harbor agents in counting migrants and the subsequent scarcity of these statistical sources; 3) the frequent change during that time of the statistical sources which recorded migrants and expatriations; 4) the change in the meaning of “emigrante” in the official statistical vocabulary. As for the statistical sources which recorded migrants and expatriations, Italian official statistics sometime considered sources roughly relating to the number of migrants, sometimes roughly to the number of expatriations. Generally, it is difficult to distinguish data relating to migrants from data relating to expatriations. Only in the case of the overseas migration the distinction between the number of migrants and the number of expatriations was possible, owing to the nominative lists of passengers embarked and landed, but even in this case the data published related only to expatriations. During the fascist period the statistical sources of enumeration were improved, but the official statistical meaning of “emigrante” changed so that comparing the data before, during and after the fascist period is only roughly possible. As for the meaning of “emigrante”, the official statistics normally adopted the one established by the subsequent laws on emigration and, because of its own prejudice against foreign migration, the fascist regime partially changed the previous laws. The word “emigrante” was abolished in favor of “Italiani all’estero” and the circular letter of the Ministry of Foreign Affairs n. 51 of the 3th may 1928 substituted the previous statistical categories of “emigrante” and “non emigrante” with “lavoratore” and “non lavoratore”. The first one related to everybody expatriated to perform manual labour or to reach relatives emigrated for work; the second one related to Italians expatriated for intellectual or high-skilled jobs and to Italians living abroad on private income. The first ones were considered as real migrants, the second ones as “ambassadors of italianità” and a deterrent against the assimilation abroad of the first. Above all, the intellectual and high-skilled workers and the Italians living abroad on private income were enumerated in different statistics. That is why the classification of migrants in “lavoratori” and “non lavoratori” prevents the statistics on migration of the fascist era from being reliably compared to the previous and the following ones.

A propensity score matching method to study the achievement of students in upper secondary schools

Giulia Roli and Luisa Stracqualursi

Abstract In the paper, we investigate the effects of some family characteristics on the achievement of students in the first year of the upper secondary schools of the province of Bologna. We employ a matching strategy based on propensity score to create treatment groups, corresponding to the values of the factor under study, with the same distribution of observed covariates. As a result, students are stratified in blocks according to the propensity score to obtain estimates of the average treatment effect using nearest neighbour matching. In order to further compare the achievements of students of upper secondary schools in the city of Bologna with those in the other towns of the province, we show that valid inference is assured by controlling for family characteristics whose influence on the outcome has been previously assessed.

1 Introduction

The investigation of the factors which may influence the achievement of students in the different levels of their education is a crucial topic in observational studies on individual learning experiences and, more generally, in evaluation researches of educational field. The substantive goals are to discern groups of students characterized by specific features which are likely to affect the educational attainments and to help teachers to properly counsel students during the school year and towards the subsequent educational levels. Despite in the last decades the free access to the learning services is assured, several studies assert that family background, in terms

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of socio-economic indicators, and family structure affect the educational attainment and the educational achievement of students with different impacts among countries and levels of education ([1]; [2]). Therefore, collecting more accurate information on family, such as educational and job qualification of parents, income and marital status, as well as students features and achievements, ensures a valid framework to investigate different aspects of the phenomenon and, as a final result, to properly define local educational policies.

In this paper, we aim at evaluating the effects of some family characteristics on the achievement of the students, in terms of success or failure at the end of the school year, referring to data on students in the first year of the upper secondary schools of the province of Bologna in year 2007/2008. We consider educational qualification of the mother and number of siblings as potential causal factors influencing the outcome. Indeed, in some previous analyses ([3], [4]) these have been emerged as covariates highly associated to the educational attainment of the same group of students. In order to further compare the achievements of students of upper secondary schools in the city of Bologna with those in the other towns of the province, we show that valid inference is assured by controlling for family characteristics. In the analysis, we employ a matching strategy based on propensity score ([5]) to create treatment groups, corresponding to the values of the factor under study, with the same distribution of observed covariates.

2 Data and methods

In order to increase the information which are commonly available, the province of Bologna, through the *Osservatorio della Scolarità* agency, experimented a more detailed collection of data during the enrollment at the school year 2007/2008. Indeed, family socio-cultural and economic conditions, in addition to the educational and demographic characteristics of the students, have been gathered through a specific questionnaire. Here, we consider a sample of $2,012$ students registered at the first year of the upper secondary schools of the province of Bologna. At the end of the year, $1,689$ students (83.95%) passed at the second year and 323 (16.05%) failed. We therefore define the outcome of interest Y as the success (Y=1) or the failure (Y=0) at the end of the first school year. As potential causal factors influencing the outcome, we denote by T_1 the educational qualification of the mother and by T_2 the number of siblings. Indeed, in some previous analyses ([4]) these have been emerged as covariates highly associated to the educational attainment of the same group of students. In particular, T_1=0 identifies students whose mothers have up to the higher education and T_1=1 students with graduated mothers and over. As far as the number of siblings is concerned, students with one sibling at most are grouped and denoted by T_2=0 and students with two siblings and over by T_2=1.

Under a causal inference framework, T_1 and T_2 are separately regarded as treatments whose effects would be estimated. In observational studies, we have no control over the assignment of the treatment to units. Therefore, we focus on a setting to select a sample where the treatment and control samples are more balanced, i.e. the marginal covariate distributions in the two treatment arms are similar. In particular, we use propensity score to select the observed covariates mostly correlated with the treatments ([5]) and then match treated units with controls to obtain estimates of the average treatment effect ([6]) using nearest neighbour method. In order to assess the covariate balance between the treated and control samples after the matching, we adopt several measures for each covariate X (or, analogously, for propensity score $e(x)$). First, the normalized difference, which can be estimated as

$$\widehat{\Delta}_{01} = \frac{\overline{X}_1 - \overline{X}_0}{\sqrt{S_1^2 + S_0^2}} \tag{1}$$

where $\overline{X}_1$ and $\overline{X}_0$ are the average of the covariate values for the treatment and control group respectively and S_1^2 and S_0^2 denote the conditional within-group sample variances of the covariate. In addition to comparing the differences in location in the two distributions, one may wish to compare measures of dispersion in the two distributions through the logarithm of the ratio of standard deviations, which can be estimated as

$$ln(S_1) - ln(S_0). \tag{2}$$

Moreover, we can investigate how what fraction of the treated (control) units have covariate values that are in the center of the distribution of the covariate values for the controls (treated), for instance by calculating the probability mass of the covariate distribution for the treated that is within, say, the 0.975 and 0.025 quantiles of the covariate distribution for the controls. An estimate of this measure of overlap is

$$\widehat{\pi}_1 = \widehat{F}_1\left(\widehat{F}_0^{-1}(0.975)\right) - \widehat{F}_1\left(\widehat{F}_0^{-1}(0.025)\right) \tag{3}$$

for treated units and

$$\widehat{\pi}_0 = \widehat{F}_0\left(\widehat{F}_1^{-1}(0.975)\right) - \widehat{F}_0\left(\widehat{F}_1^{-1}(0.025)\right) \tag{4}$$

for controls, where $\widehat{F}_1(\cdot)$ and $\widehat{F}_0(\cdot)$ are the empirical distribution function of X in the subpopulation of treated and control units respectively and $\widehat{F}_1^{-1}(q)$ and $\widehat{F}_1^{-1}(q)$ (q=0.975,0.025) are their inverse.

We further aim at comparing the achievements of students of upper secondary schools in the city of Bologna with those in the other towns of the province, controlling for the family structure and background. We thus define an additional treatment T_3, which assumes values 1 if the students is enrolled into a school of the city, and 0 otherwise. The propensity score matching method described above is again adopted to create balanced treatment groups.

In the specification of the propensity score for each treatment, the following covariates available from the data collection are considered: sex, nationality and type of school (academic, vocation or technical institute) of pupils, type of employment of the head of the household (for T_2 and T_3) and of the father (for T_1), educational qualification of both parents (for T_2 and T_3) and of the father (for T_1), marital status of parents, number of siblings (only for T_1 and T_3).

3 Results and conclusions

As far as the educational qualification of the mother T_1 is concerned, the matching strategy creates 882 controls (i.e. students with mothers having up to the higher education) to be compared with 382 treated pupils (with graduated mothers and over). The balance in the covariate distributions is excellent. Indeed, for the propensity score the normalized difference in covariate means $\widehat{\Delta}_{01}$ is 0.53, i.e. less than a standard deviation, the logarithm of the ratio of standard deviations is not far from zero (0.067), and the coverage proportion is above 0.90 for both treatment groups ($\widehat{\pi}_0$=0.90, $\widehat{\pi}_1$=0.95). A positive and significantly different from 0 effect of higher education of mothers on the school success of pupils is estimated. This amounts to 0.049 (s.e.=0.021) and is smaller than the one estimated by neglecting the overlap, roughly comparing students treated with all controls (0.090, s.e.=0.020).

A negative but negligible effect of the number of siblings on the outcome is estimated (-0.042, s.e.=0.027). We compare 280 pupils with more than one sibling with 943 matched units with one sibling at most after assessing the overlap in the covariate distribution ($\widehat{\Delta}_{01}$=0.20, logarithm of the ratio of standard deviations=0.174, $\widehat{\pi}_0$=0.90, $\widehat{\pi}_1$=0.97).

The central role of family background and structure is further pointed out when we are interested in evaluating the effects of different factors on the educational attainments of pupils, such as comparing province versus city schools (T_3). Indeed, by ignoring the family features, improperly comparing the success rates of pupils enrolled into the schools of Bologna with those of the province, we derive a positive effect, which amounts to 0.036 (s.e.=0.017). Conversely, controlling for the family characteristics leads to a negative and negligible effect (-0.013, s.e.=0.024).

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Normalized multiple variability indices for statistical rates: studying the global demographic convergence

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Abstract We introduce some statistical methods for studying in a multidimensional viewpoint the global demographic convergence of the populations towards a common pattern across time. Many demographers have empirically tested the convergence using statistical indices of variability (the so-called "σ-convergence") but they focused on a unidimensional viewpoint, that is testing separately the convergence of each variable at a time. Let consider a set of k variables each observed on n populations across time. Since the demographic transition theory refers to the changes of births, mortality and age structure over time, we consider the crude birth rate, the crude death rate, the infant mortality rate and the aging index. As these variables are statistical rates, we define suitably the variance and covariance matrix S and the correlation matrix R. Then, we take the determinant of S and the determinant of R as absolute multiple variability indices. In aim to evaluate the magnitude of the convergence, we apply a linear normalization procedure to each absolute index, obtaining the corresponding normalized one, with values comprised between 0 and 1. Here, we use the normalized indices for testing the demographic convergence of the European populations.

1 Introduction

We aim to introduce and use some suitable statistical methods for studying in a multidimensional viewpoint the global demographic convergence of the populations towards a common pattern, that is the focus of the demographic transition theory.

Let consider a set of k variables each observed on n populations across time. Many researchers have empirically tested the demographic convergence using some statistical indices of variability - the so-called "σ-convergence" (see, for instance, Cagiano de

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Azevedo and Ambrosetti (2001); Casterline (2001); Dorius (2008); Goesling and Firebaugh (2004); Neumayer (2004); Sala-i-Martin (1996); Sebastiani (2010)). If the variability is low, it means that the populations converge towards a common profile. Conversely, if the variability is high, it means that the populations are quite different from each other and from the common profile and, therefore, the convergence is not achieved. All the existing studies focus on a unidimensional viewpoint, testing separately the convergence of each variable at a time.

Recently, in aim to deal with the problem in a multidimensional viewpoint, we used an absolute multiple variability index (Sebastiani (2010). Since the demographic transition theory refers to the changes of births, mortality and age structure over time, we considered the crude birth rate, the crude death rate, the infant mortality rate and the aging index (by symbols, respectively CBR, CDR, IMR and AI). As these variables are statistical rates, we defined suitably the variance and covariance matrix *S*. Assuming that the variables are independent each other, we took the trace of *S* (by symbol, tr(*S*)) as absolute multiple variability index. It measures the average distance of the *n* populations from the common profile. In aim to evaluate the magnitude of the convergence, we applied a linear normalization procedure to tr(*S*)) after determining both its minimum and maximum values, obtaining the normalized index $\mathrm{tr}(S)_{norm}$ that takes values comprised between 0 and 1.

Starting from *S*, here we propose other two absolute indices that summarize the multiple variability of the *n* populations, without assuming independence among variables. We also normalize these two absolute indices. We apply the normalized indices for testing the demographic convergence of the populations belonging to the European Union (EU) towards a common pattern, comparing the results with those obtained by means of $\mathrm{tr}(S)_{norm}$.

2 The normalized multiple variability indices

Let $S = \{S_{ij}\} \in \mathcal{M}_{k,k}$ the variance and covariance matrix of the *k* demographic rates. Since both the average rates $\bar{t}_i$ and $\bar{t}_j$ of the *n* populations are weighted averages of the *n* rates $t_{hi} = \dfrac{x_{hi}}{p_{hi}}$ and $t_{hj} = \dfrac{x_{hj}}{p_{hj}}$ with weights respectively equal to $\dfrac{p_{hi}}{p_{.i}}$ and $\dfrac{p_{hj}}{p_{.j}}$, we believe that is right also to define the S_{ij} terms as weighted averages where the weights are related to those aforesaid $(i, j = 1,...,k\,; h = 1,...,n)$.

Let $R = \{R_{ij}\} \in \mathcal{M}_{k,k}$ the correlation matrix obtained starting from *S*.

For measuring the multiple variability of the *n* populations, we take both the determinant of *S* and of *R* (by symbols, respectively, det(*S*) and det(*R*)). They measure the volume of the *k*-dimensional space where are the *n* populations. For normalizing det(*S*) and det(*R*), we determine both their minimum and maximum values and then apply a linear normalization procedure, that is:

$$0 \le \det(S)_{norm} = \frac{\det(S) - \min(\det(S))}{\max(\det(S)) - \min(\det(S))} \le 1 \qquad (1)$$

$$0 \le \det(R)_{norm} = \frac{\det(R) - \min(\det(R))}{\max(\det(R)) - \min(\det(R))} \le 1 \qquad (2)$$

For determining numerically the maximum values, we implemented an algorithm in R language.

3 Data and results

We consider six different frameworks of the EU corresponding to the several expansions, specifically with 6, 10, 12, 15, 25 and 27 members, and the six corresponding groups of national populations. We indicate these groups by the symbols EU6, EU10, EU12, EU15, EU25 and EU27, respectively. For each population we observe the CBR, CDR, IMR and AI for every year from 1960 to 2007 (sources: the Council of Europe, Eurostat and the United Nations).

For each group of populations, we apply both the indices (1) and (2) considering different combinations of indicators and thus different values of *k*. Specifically, amongst all the 11 possible combinations of *k* indicators corresponding to different possible values of *k* (that is, *k* = 2, 3, 4), we consider only those which always include CBR and CDR. In fact, the demographic transition theory refers to the changes of births and mortality over time. Thus, when we take *k* = 3, we consider only two combinations of indicators, namely the former is CBR, CDR and IMR, and the latter is CBR, CDR and AI.

The results confirme that the European populations converge towards a common pattern. Indeed, the indices take on average very small values. For *k* fixed, they are decreasing to increasing *n*, except for *k* = 2 where EU6 shows on average a few higher values than the other groups due to the increasing CBR in some very large populations.

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New techniques to collect, process and store agricultural data

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Abstract As society transforms and is transformed by new technology, so there are new ways in which researchers collect and analyse data and new forms of data to collect. The world wide web provided a suitable environment to set up data capturing tools; the enhancement of telesurvey techniques allowed for collecting a huge amount of data on agricultural variables and, more recent, photographic techniques will allow to gather several statistical information in a very quick way reducing the burden for participants At the same time the wide diffusion of wireless data networks enables gathering data from sensors and storing them in a new way. The new tools make easier the arrangement of a well structured network to support a cloud computing approach. Moreover to improve new ways to get high quality information in a quicker way such a type of system facilitates the building of the data matrix, i.e., the starting point for a reliable set of results from statistical analyses.

1 Data collection: STIMA and AGRIT

The objectives of improving the metadata definition and the efficiency of data collection, validation, processing, storage, and dissemination can be more easily achieved with the help of new hardware and software tools.

Presently, agricultural data capturing is performed by means of a web based

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application (STIMA) and a GPS technology managed by the GIS software (AGRIT).

1.1 Internet Data Collection: Stima

Internet Data Collection (IDC) is a means of speeding the collection of data where respondents fill in a web based form. The system administrator will take care of merging data from different sources if other data capturing modes are allowed for the survey and, in case of necessity, he will have the option to retrieve and check them more times. The collection is run on a secure web page and it tailored to meet the needs of each customer, to be interactive and helpful to users.

STIMA is an IDC web application developed in a PHP software that includes a monthly survey of agricultural crops on an estimate basis (by field experts); the phenological cycle of the crops is taken into account and for each area the amount of hectares and production in quintals is required. It can only be entered by appointed users through an account and a given password. Data entered on line are written in a database that serves as a storage means. Users can retrieve the information and complete the form if necessary. Data submitted are immediately transferred to a local host or a webserver. The online survey form has validation checks built in to ensure user is giving usable data; that reduces the time spent checking for incomplete forms and calling up respondents to obtain the missing data.

STIMA includes a toolkit for managing statistical data, which minimises the need for developing and supporting database-specific programs. This toolkit has facilities for database administration (managing user access rights, defining dimensions, adding a country, etc.), data validation, etc.

1.2 GPS technology and GIS software: Agrit

The development and implementation of precision agriculture or site-specific farming has been made possible by combining the Global Positioning System (GPS) and Geographic Information Systems (GIS) used to analyse data collected from GPS field surveys. These technologies enable the coupling of real-time data collection with accurate position information, leading to the efficient manipulation and analysis of large amounts of geospatial data. GPS is the most modern means of mapping and surveying and it is widely used in several fields, among those, agricultural data gathering that can replace traditional methods.

Some research activities have already been carried out. Among those AGRIT, a sample survey based on an area frame obtained overlaying a regular grid on aerial photos of the whole national territory.
AGRIT methodology has the merit of combining data from direct survey with those obtained from aerial and satellite photos. Since 2009 technicians have conducted surveys using digital mobile tools (a sample of about 80.000 points obtained through the use of GPS equipment, is selected from the frame taking into account the precision of the estimate expected) that allow managing the entire survey process. Data collection is done more than once in a year in order to take into account seasonality of crops. Such tools allow not only the reduction of paper documents but also an overall optimization of a survey, monitoring the quality of data collected in real time.
However, more evidence is needed for evaluating the accuracy of GPS measurements for very small plots, with low production or with high variability, in the presence of abrupt slopes and under cloudy or raining weather conditions. It is a very expensive technique and it requires well-trained enumerators, the results depending on the precision of mapping and on the time of survey.

2 Future developments: Mobile-Agriculture and Cloud Computing

The spread of public wireless data networks, which enable gathering data from sensors and distributing information, will improve the collection of low cost detailed information. Mobile phones can be connected to a mobile channel, creating a local wifi network to which more than one device can be connected.
Researchers can then simply follow a step-by-step process to gather data, either by entering text numbers or by answering a series of questions designed to meet specific needs. Dynamic information can be gathered from external sources, thus improving the integration of data. The information collected can be instantly sent to a server or securely stored on the mobile phone until the researcher is back within the range of a cellular network.
The combination of GIS, GPS, computing hardware and Internet communications has now enabled the construction of general-purpose data centers that can be reconfigured by command to support any software application in a few minutes.
Cloud Computing is: “a type of parallel and distributed system consisting of a collection of interconnected and virtualized computers that are dynamically provisioned and presented as one or more unified computing resources based on service-level agreements”. A shared Cloud data center will typically have over 1000 computers, which can support at least 100.000 user "virtual" computers. A research center that works with a crop could choose a group of

similar varieties that have been cultivated for a long period. The center will already have basic long-term data across many seasons. These data could be stored in one or more Cloud Computing facilities and could be supplemented from now on by extensive sensor data, collected and made available in near real-time from the fields where the varieties are cultivated. Software can be written to run "on the cloud" and a researcher can create a personalized tool with several features deriving from the sum of single web services. Besides, it is possible to transfer data from a PC to a *Cloud*, thus having it available anywhere.

The user just needs to have access to the Internet and an account with the GIS application service. Traditionally, GIS applications would need dedicated clusters and storage space to compute and analyze large amounts of data. With the help of Cloud Computing, this processing and storage responsibility can be offloaded to a Cloud service provider. What is interesting about this field is that Cloud Computing in agriculture is benefiting from the integration of a number of improvements in mobile, sensor, GIS, GPS and other technological developments in tandem. Use cases for agricultural production and research projects go far beyond simple remote hosting. Once a data collection like this is available in a Cloud data center, a series of analytical studies could be commissioned. Cloud Computing will make it possible to overcome obstacles deriving from the use of local databases, improve accuracy and timeliness in releasing data.

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Social Indicators: the key to measure the well-being?

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Abstract The social indicators, from 1960 in USA and from 1970 in Europe, are considered essential to measure the quality of life. Recent studies revealed that the well-being perception was not only influenced by Gross Domestic Product (GDP). The purpose of study is to evaluate the well-being in the Italian regions taking into account GDP, and other objective and subjective socio-economic indicators.

1 Introduction

Recently, it is increased the interest in new measures of wealth that can surpass the traditional economic indicators such as Gross Domestic Product (GDP). In fact, a gap between the perception of well-being of the population and standards measures of important socio-economic variables such as inflation, unemployment and economic growth has emerged.

The same creator of GDP, the economist Simon Kuznets, recognized that the use of this indicator was beyond the intentions: already in 1934 he had warned that "the welfare of a nation can scarcely be inferred from a measurement of national income". The critique of Kuznets has since been seconded by many prominent economists, including a number of Nobel laureates (Daniel Kahneman, Robert Solow, Joseph Stiglitz, Amartya Sen and Muhammad Yunus) [1]. The awareness that the concept of welfare cannot be just explained by monetary measures, but also by subjective and social factors, has caused in the 1960s the birth of the Social Indicators Movement, in the United States. The Movement was rapidly spread in all European countries and involved many international organizations and the European Community. Since the mid-70s began a period of indifference to the social indicators. Only in the last decade it was increased the interest in these indicators [2].

In Europe there is in progress a debate on the social indicators. For instance, the report "Indicators for social inclusion in the European Union" prepared for the Belgian government in 2001, with the aim of establishing a guide for the construction of a set of social indicators to be used to monitor and evaluate the situations in the European

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countries, had identified the following areas: economic, employment, regional differences, education, housing conditions, health and social participation [3].
Moreover, in February 2008, the President of the French Republic, Nicholas Sarkozy, unsatisfied with the present state of statistical information about the economy and the society, created a multi professional Commission with the aim to identify the limits of GDP as an indicator of economic performance and social progress. Therefore, the Commission has identified eight dimensions that should be taken into account and considered simultaneously: material living standards area, health, education, personal activities including work, political voice, social connection and relationships, environment, insecurity [4].
In Italy, the attention to social indicators has developed considerably later than in other countries [2]. With regards to this, Antonio Marzano and Enrico Giovannini, the Cnel (National Council for Economics and Labour) and Istat (National Institute of Statistics) presidents, have initiated the creation of a “Steering Committee on the measure of the Italian society progress” composed of representatives of social partners. The group's objective is to develop a multidimensional approach to wellness that integrates the GDP with other indicators. At the end of 2011 a set of indicators will be identified [5].
The purpose of this paper is to evaluate the well-being in the Italian regions taking into account the eight areas recognized by the Commission of Sarkozy, using both subjective and objective indicators.

2 Methods

An observational, cross-sectional and ecological study was conducted on the 20 Italian regions referred to 2008, mainly.
Official statistical data provided by the National Institute of Statistics (Istat), Ministry of the Interior, Institute for the Protection and the Environmental Research (Ispra) and World Health Organization (WHO) were analysed to calculate indicators.
In particular, from Istat were chosen indicators from following surveys:
Aspects of daily life: an annual multi-purpose survey which has the whole social informative framework. It collects a set of data concerning individuals, households and events which affords to construct and analyse the citizen's demand, besides comparing it with services supply;
Italian Labour Force survey: a household-level survey carried out with a detailed questionnaire every quarter - in the months of January, April, July and October - since 1959. The sample includes all men and women aged between 15 and 64 inclusive who were employed at the time of the survey - including the self-employed;
Income and living condition: the survey is based on the European Union regulation that defines the Eu-Silc - European Statistics On Income and Living Conditions - project. The survey replaces the European Community Household Panel, and its main goal is to supply comparable data for studying the income distribution, well-being and quality of life of families and the economic and social policies being adopted at national and/or European levels.
From Ministry of the Interior, a database on crimes annually committed and reported to Italian police force was taking into account.
From Ispra, data pertaining to the production and separate collection of waste urban at regional level derived from information transmitted by public and private subjects that, for various reasons, collect information on waste management, were considered.
From WHO the database “Health for all”, the territorial informative system that contains 4,000 indicators on health status and services, was used.
The indicators included in the study were the followings:
for material living standards:

gross domestic product (GDP) per capita; family average expenditure in euro; family net income in euro; perceived of economic situation: percentage of people of 14 years and older which are too much or enough satisfied of their economic situation; perceived house expenditure: percentage of families that considered too high their house expenditure;
for health:
life expectancy at birth; life expectancy without disability; chronic diseases: percentage of people which have at least one chronic diseases; perceived of health status: percentage of people of 14 years and older which are too much or enough satisfied of their health status;
for education:
educational level: percentage of people of 15 years and older people with diploma, degree, doctor's degree;
for personal activities:
employment rate for 15-64 age; perceived free time: percentage of people of 14 years and older which are too much or enough satisfied with their free time;
for political voice:
political voice: percentage of families which talking politics at least one time in the week;
for social relationships:
perceived family relations: percentage of people of 14 years and older which are too much or enough satisfied of family relation; friends: percentage of people of six years and older that see their friends at least one time in the week; perceived friendly relations: percentage of people of 14 years and older which are too much or enough satisfied of friendly relations;
for environment:
separate collection of waste fractions: percentage of separate collection of waste fractions out of the total; perception of air and noise pollution distinctly: percentage of families which considered that there is too much or enough air and noise pollution in their living area; perception of dirtiness in the street: percentage of families which considered that there is too much or enough the perception of dirtiness in the street;
for insecurity:
perception of criminality: percentage of families which considered that there are too much or enough crime problems; criminality rate: persons accused/arrested per 100,000 inhabitants.
A Principle Component Analyses (PCA) was carried out for the available data.
The French SPAD Package Software 5.0 was used to perform the analysis.

3 Results

The first two principal components (PCs) accounted for 68% of the total variability. The first component accounted for 47% and the second 21% of variance. The PCs were interpreted according to the correlation coefficients represented in the correlation circle (Figure 1).
The first PC was highly and negatively correlated with variables expressing the life expectancy without disability, perceived of health status, GDP, employment rate, family expenditure, family net income, perceived of economic situation, separate collection of rubbish, political voice, perceived free time. The second PC was mainly positively associated with the variables of perception, as perception of air and noise pollution, perception of criminality, perceived friendly relations.

Figure 1. Correlation circle of the variables on the two Principal Components (Factor 1 and Factor 2)

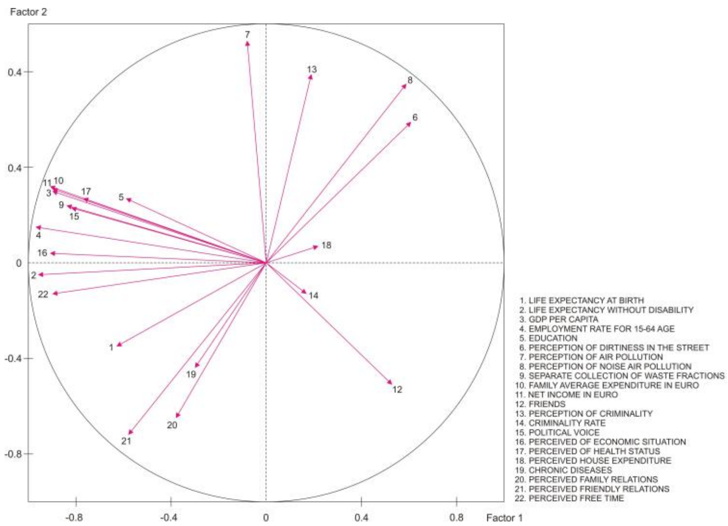


Figure 2 represents the PCA factorial space. The first axis opposes Trentino Alto Adige to Campania, Sicilia, Puglia and Calabria while it is evident the opposition between Molise, Basilicata and Calabria to Lazio, Campania and Lombardia along the second axis.

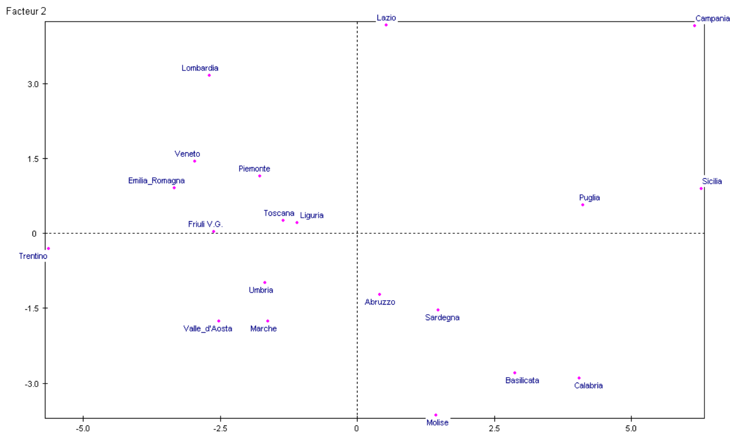
In the first quadrant, Lazio and Campania show negative perception of pollution and criminality and high level of satisfaction of friendly relations, while Puglia, Sicilia and Campania are characterized by worse objective and subjective economic situation and perceived free time.

In the second quadrant there are regions characterized by high level of good economic situation (objective and subjective side) and perceived free time (especially Emilia Romagna and Veneto) and negative perception of pollution and criminality and high level of satisfaction of friendly relations (especially Lombardia).

In the third quadrant, there is a first group of Northern and Centre regions (such as Trentino Alto Adige, Valle d’Aosta, Marche and Umbria), especially characterized by good economic situation (both objective and subjective) and perceived free time coupled with positive perception of air and noise pollution and criminality and lower satisfaction of friendly relations.

Finally. In the fourth quadrant, Basilicata and Calabria detain a negative perception of pollution, criminality and high level of satisfaction of friendly relations with a good economic situation (both objective and subjective) and perceived free time (Molise just presents the last situation).

Figure 2. Distribution of the Italian regions in the PCA factorial space.



4 Conclusions

This study revealed that social indicators, together with the economic aspects, were essential to explain the well-being.

In particular, the first component showed that the variables on perception of the economic situation, state of health and free time are important as objective economic (such as GDP, family expenditure, family net income, employment) and health variables (such as life expectancy without disability); therefore, the first component expresses the well-being linked to both health and monetary aspects, in objective and subjective sense.

The second component, characterized by the perception of environment, insecurity and social relationships, such as perception of air, noise pollution, criminality and perceived friendly relations, can be defined the component of context.

It is quite evident that well-being is not only associated with economic factors, but closely influenced by health and economic situation in the first place, and the context surrounding the individual, in second place.

In fact, in the welfare assessment is not enough to consider only the objective dimension of a phenomenon, but also the subjective perception that individuals have of the condition in which they live and their degree of satisfaction [6].

This study also reveals that, analyzing the first component, there is not a real gap between the measure of variables such as GDP, income and expenditure and the general perception of the economic situation.

In conclusion, the study revealed that in Italy the GDP and other economic measures are not sufficient to describe the well-being, because it is also influenced by state of health and perception of health, insecurity, environment, personal and familiar activities, and social relationships. Besides, to define what well-being means-a multidimensional definition has to be used.

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Local Welfare and the Partnership between Public and Nonprofit Institutions

Massimo Lori, Franco Lorenzini, Sabrina Stoppiello

Abstract Data from Census of industry and services carried out in 1991 and 2001 allow to detect the main changes of Italian society, and in particular those related to the social protection system transformation, thanks to the survey of public and private institutions. According to this, the aim of the paper is to describe the social services system at local level, taking in consideration the level of coverage of the social services demand and the role played by different actors (public, private, nonprofit). Moreover, the analysis intends to verify empirically whether the development of nonprofit institutions in Italy occurred in cooperation or in competition with the public sector. For this purpose, data from both census of industry and services and municipalities' social spending will be analyzed.

Keywords: Local welfare, Census of Nonprofit Institutions

1 Introduction

Since the seventies most European countries have been affect by the financial and organizational crisis of welfare systems, linked to a number of factors including the high growth of social spending, changes in demographic structure and the expansion of demand for new services, the bureaucratization process of the PA. This crisis has triggered a process of welfare reform aimed at downsizing of public policy and at the same time, the progressive entrustment of social services to nonprofit organizations and / or private companies. Social policies have been reoriented through a new regulation of the relationship between state and private service providers, in particular with the introduction of mechanisms for coordination of the market. In Italy outsourcing of

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social services has occurred through partnerships between public institutions and nonprofit organizations. These have taken an increasingly central role in providing these services. According to this backdrop, the work aims to assess the provision of social assistance services in Italy, both with respect to the role of various providers and the demand for social services. As a result, Italian provinces are classified into different "welfare regimes".

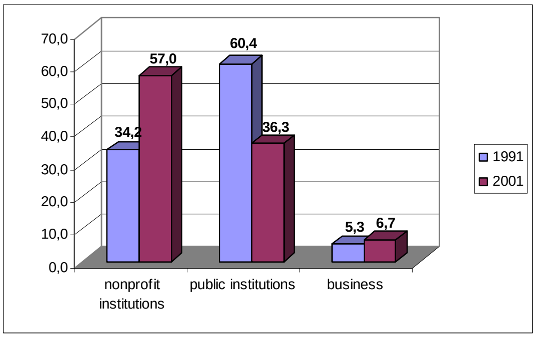
The data used here cover units active in the welfare sector collected by Istat in the last two General Censuses of Industry and Services (1991 and 2001)[1]. These data were complemented with information about the per-capita social expenditures by municipalities in 2000 made available by the Department of the Interior[2].

2 Main features of the Italian social service sector

In 2001 about 34 thousand local units (UL) provided social services, of which 72.6% belonged to nonprofit institutions (NPIs), 21.2% to public institutions (PIs) and 7.2% to enterprises. The human resources employed amounted to 322 thousand paid workers and 342 thousand voluntary workers (these collected only in the NPIs, in 2001).

Social service providers increased in the last decade. The increase was 44% in terms of UL and 48.6% in terms of employees. At the same time, the composition of provided has also shifted dramatically in favour of the nonprofit sector, both in terms of UL and human resources used, with a significant downsizing of the public presence. The figure 1 shows the composition of social service sector by employees of different institutional players. (Fig. 1).

Figure 1 - Employees in the Social service sector by institutional sector (1991/2001)



Source: Istat, 7th General Census of Industry and Services and 8th General Census of Industry and Services

The geographic distribution and the employment dimension of the institutional players have been analyzed. The public contribution has been estimated also through per capita spending carried out by municipalities.

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1 The general censuses represent the only informative source that allows the statistic analysis to an elevated territorial detail.

2 The expenses of municipalities for social functions include the following: management of childcare facilities, residential structures and refuges for elderly, domiciliary assistance; assistance, charity and other public services for individuals.

Results from a factor analysis (PCA) of a set of indicators highlight two main latent dimensions. The first factor captures the relevance of public and nonprofit sector provision of social services: as the second factor indicates the weight of the profit sector. The results show non-competitive behaviors between public institutions and the nonprofit sector. Therefore nonprofit development is not read only as alternative to the downsizing of public policy, strictly linked to the “government’s failure”.

Using cluster analysis, Italian’s provinces have been split into 5 groups based on different welfare provision regimes schemes, linked to the specific demand for services (Fig. 2).

The first cluster (31% of provinces) describes the large public sector contribution (in terms of social expenditure and geographic distribution) associated with NPIs presence highlights a business vocation in the management of welfare policies and, therefore, could be defined «extensive». In particular, some provinces in the North-West and Centre of Italy (Alessandria, Vercelli, Torino, Biella, Varese, Novara, Ferrara, Forlì-Cesena, Piacenza, Terni) are associated with this profile. Compared to demand indicators, the framework is structured, with various indicators above the country mean, including, the elderly index (78%), immigrants incidence (56%), disability incidence (59%), and the crime rate (30%).

The second and the third clusters are similar with a large amount of public and nonprofit dynamic institutions operating in the welfare sector. As such, these welfare systems can be labeled «institutional».

In particular, the second cluster, which includes 29% of Italian provinces, is characterized by the presence of both PIs and NPIs, and also by the few business activities in welfare policies. The main provinces of this cluster are in the North-East (Belluno, Pordenone, Gorizia, Cremona). In this cluster, the welfare demand stems from immigrants (63%), elderly (60%), and people with disability (50%). The presence of adolescents is lower than in other clusters, while in 27% of cases provinces have high crime rates.

The scores of the third cluster, including the autonomous provinces of Trento and Bolzano, point to the «institutional» model, where the strong weight of PIs is linked to a capillary distribution of NPIs. Users in these systems are mainly adolescents and immigrants.

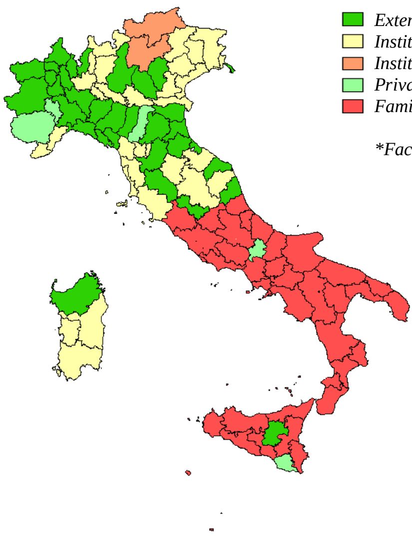
The fourth cluster, which comprises the provinces of Cuneo, Modena, Asti, Isernia and Ragusa shows a different model of welfare system: more «private», where welfare policies are carried mainly by *for-profit* sector. However, in the provinces sited in the North of Italy are present also public and nonprofit institutions. Demand, in these contexts, is concentrated on elderly and immigrants (North) and adolescents (South).

The last cluster, (33% of provinces), represents systems where the welfare model is relies on families. This is characterized by a lack of public supply of social services along with a scarce development of both NPIs and for-profit organizations. The provinces included in this group are mostly in the Centre and South of Italy. Nevertheless, the environment is less fragile in some provinces (Rieti, Chieti, Frosinone, Taranto, Trapani e Lecce) where the for-profit sector is relatively more present. The welfare’s users are mostly teen agers (68%) and people with disability (76%).

3 Conclusion

The developed analysis aims to catch the articulation of the social service sector in Italy, related to the involved institutional actors and the produced services' users. The obtained results show that the principal social service's producers in Italy are public and nonprofit institutions, therefore organizations characterized by a non lucrative orientation. Besides that, the results confirm the consolidated hypothesis that the PIs, in the downsizing of public policy, "choose" as main partner the NPIs rather than the firms. The multidimensional analysis of the provinces shows a variegated context, with differentiated local welfare systems, displayed on a continuum whereby the extremes are constituted by the excellent situation of the «advanced institutional» model (on the hand) and from the evident uneasiness in the «familistic» model (on the other hand), where the absence of the institutional actors in delivering social services might be compensated by the family nets and /or the proximity nets. The profit sector as social service's producer is limited only to specific territorial contexts.

Figure 2 –Welfare regimes in Italy



Clusters	N°	Factor 1*	Factor 2*
Extensive	32	4.3	4.7
Institutional	30	3.7	2.5
Institutional Advanced	2	9.2	0.6
Private	5	3.9	8.4
Familistic	34	1.2	5.6

**Factors vary from 0 to 10*

Source: Istat, 8th General Census of Industry and Services

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Valorisation and innovative use of historical statistic sources. The Italian experience on judicial criminal statistics.

Tagliacozzo G., Corazziari I., Panaccione D.

Abstract
The gathering of judicial criminal statistics has begun since the last decades of 1800. Data, collected from different administrative sources, were continuously changed over time, due to modification of criminal laws and proceedings and in the management of data. The direct extraction from administrative database has widened the information contents, allowing the possibility to include the collection of misdemeanours, to better qualify crimes detailing them more and to code places at a municipality level. In the future it will be possible to integrate some type of crime of particular interest with information about the context and about the victim. The improvement of the informativeness, flexibility and the innovation of data warehouse will make possible to focus the attention not only on the author, but also on the crime event, on the offended part or on the process as a whole, depending on the interest knowledge.
Keywords: criminal statistics, judicial authority, convicted, data source integration and armonization

1 Introduction

The whole picture of crime in Italy derives from the integration of different information sources, both administrative and population surveys. To gather an accurate and more as possible exhaustive measure and analyse of the phenomena, a single source of data is not enough. The measure of crime levels for example can be misrepresented if based only on the number of reports to police or penal actions: the dark figure of crimes and the safety perception of citizens from victimization surveys should be also taken into account.
Considering judicial criminal statistical, the National Institute of Statistic of Italy has a long tradition dating back to the last years of 1800 (Istat since 1926, before it was the Statistical office of the Agricultural Ministry). In details, the time series about convicts and Institutes of education and prison start since 1863; the one about "Reported felonies by known authors prosecuted by the Judicial Authority and felonies by

unknown authors" since 1880; the one about "Convicts for felonies with a definitive sentence" since 1890; statistics about crimes reported by the Police to the Judicial Authority start in 1955. Each of the above sources has different strength and weakness points, in terms of timeliness in disseminating data, accuracy and reliability, the possibility to analyses specific details (territorial, type of crime, author, victim).
Finally since years '90 The National Institute of Statistic provides another source of data to complete the picture of crime: the victimization surveys *Safety of citizens' and Safety of Women*. Victimization surveys aim to estimate the dark figure of crime, that is number of crimes not known both by the police and the Judicial Authority, their dynamics, victims' and authors' profiles, the safety perception of citizens.The survey on Women safety focuses on physical and sexual violence against women, by partner and non partners.
Since 2009 the National Institute of Statistic has dedicated a new attention to the phenomena of criminality, joining the two main sources of data, administrative and from population survey, under a unique office, aiming to integrate different sources in order to fulfil the great and more and more complex and detailed demand of statistical information about the phenomena.

1.1 A new approach to criminal statistics: aims

The reorganization of criminality statistics has given a new challenge that, starting from a renewed analysis of the needs to better understanding and knowing the criminality phenomena, and considering the increased capabilities in managing and processing data, has caused the definition of new goals to improve quality of statistics, and to clear and overtake some information limits. Among the main goals are the following:

1) The need to plug a gap of information, completing and disseminating some information until now only partially provided (for example: misdemeanors; quality of crimes' classification, victim information), integrating databases with new strategic information (for example: victim gender, if the victim is a physical or juridical entity; the possibility to indicate if the crime is of Mafia-style). A new reorganization of the whole structure of the data is to be considered and analysed, aiming at assuring that part of the information be not lost in some phases of the data gathering process and in order to enhance it.

2) The quality of the information: since years 2000s the different sources of records were made electronic, while previously gathered on paper models, by the competence offices (Prosecutor's Offices, Judicial District, Police). This important modernization process has not been fully supported by suitable actions to train and sensitize involved operators to acquire a statistical approach to data gathering. It is important to invest in the cooperation among the different Institution involved at this aim. At the same time the data processing in Istat has been renewed also, developing automatic and exhaustive control and validation algorithms aimed at reducing at most manual corrections in order to make timely corrections.

3) Reference period.

Data from administrative judicial criminal statistical database are referred to the time of inscription of the information in the registry. The number of inscriptions does not measure the number of crimes happened in the reference year. More sophisticated analysis managing great amount of data can compensate for such a limitation, collapsing data from more than one reference year, to focus on the year when the crime was committed, or the year of the sentence.

4) A further very important and at the same time very ambitious aspect is the possibility to link database from different sources: that would allow following the procedural course of a proceedings or particular crime or author from the report of the event to the final sentence of the Judicial Authority. The study of the 'transformation' of crime across the *judicial course* could be possible, as would be the analysis of the so called *criminal careers* focusing on authors.

5) Strategies to disseminate the statistical information, through innovative methodologies in processing, elaborating and reporting the data. Data demand on criminality can be at a macro level, asking about global levels of criminality in Italy, or at micro level, asking for details about specific crimes. Different type of detailed queries about crime have to be implemented as some territorial details, but also different unit of analysis should be allowed (the crime, the judicial trials, the author or the victim).

6) A further aspect to be considered is the need of elaborating data comparable at an International level. Taking into account differences in Law and Order Systems among Countries, it is essential to find common points to harmonise major crime definitions and formulate a shared or comparable system of Crime Classification.

1.2 Case study: the data base on Convicted by Felonies or Misdemeanors

The Istat collection of statistical data Convicted by Felonies or Misdemeanors with definitive sentence gather information from the database of the Central Criminal record office, that record individual characteristics of convicts whose irrevocable definitive conviction has been given. Data information regards the proceeding as a whole, the convicts, the committed crimes, penalties, preventing measures and possible benefits.

1) Reference period.

Extraction of data to be gathered by Istat is actually based on the recording date of the proceeding in the registry. Data provide the date of the proceeding, of the sentence and of when the crime was committed. If the number of convictions is to be measured in the reference year it should be used the sentence year, or the year when the crime happened, collecting together more files by year of registration.

2) Different unit of analysis, flexibility

The old database was structured in a rigid way, producing different type of records (proceeding, author characteristics, committed crimes, penalties, security measures). A sequential file by convict was prepared by Istat, selecting the most serious crimes.

Actually a new relational structure is considered in order to retain the whole information about all the committed crimes of a convict by proceeding. The analysis both by crimes and by convicts will be possible.

3) The legal classification of crimes
Aiming at the legal classification of crimes, the source of the law (if penal, street code, special laws etc.), the year, number of the law and of the article and the version of it are used. Other information are relevant to correctly classify crimes, as commas or letter. In the next future the Central Criminal record office will provide also these information.

4) Statistical Data Quality
The administrative database was realised to attend interrogations to the system about a single proceeding (convict). The need to meet standards of data recording in this context was not felt as important. A cooperation has started between Istat and the Central Criminal record Office, with the aim to improve the data quality, starting from the definition of standards to record and validate data.

Similar consideration to the above ones can be done regarding the data gathered from the Ministry of Justice about crimes reported to the Judicial Authority for which a penal actions has started (Crime Register from Prosecutor's Offices).

2 Conclusion

To meet the growing demand of information from Institutions and researchers about crime and criminality phenomena, given the availability of a great and increasing amount of data from different sources (population surveys and administrative sources), a coordinated and synergic action involving all the providers of data was required.

Such a coordinated action aim at enhancing the peculiarities of each source of criminality data, giving at the same time attention and care to the implementation of the potentialities of relational informative databases. Such databases are aimed at holding the whole information of the different sources, taking into account the possibility of inquiring the system with specific and restrained request, but also with more general request about the overall trend of criminality in Italy.

An important issue related to the need of integrate the two above sources of data (administrative and population) is the measure of the burden of crime: population data about crimes give a more reliable measure of the burden of crime, how common people perceive it and the workload of all the actors involved in fighting it, notwithstanding their inner weaknesses related to non-response, sampling errors, and the impossibility to record some type of crimes as for example those against companies or about mafia. Administrative data from the police measure the victims propensity to report crimes and at the same time the police propensity to record them, also they give a measure of the workload of the police, the last is also true for the other agencies involved as courts, judicial authorities whose data can give also a measure of their efficiency.

Following the above developing lines a global picture of criminality will be possible, allowing to approach and switching easily among the topic from different but related points of views as the offender, the victim, the other actors fighting crime and facing the consequences of it. Furthermore other important analysis relating crime variables to economic and social ones can be made in studies aimed at individuate the main determinant of criminality.

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Using web widgets for monitoring the Census acquisition process

Leonardo Tininini and Antonino Virgillito

Abstract - Although the web is increasingly used to support several phases of the statistical data life cycle, little interest has been devoted so far to use the web for publicly monitoring the acquisition process, thereby providing an effective feedback to respondents and users. In this paper we illustrate the main features of a collection of so-called web widgets (self-contained modular web components), that were developed for monitoring the 2010 Italian Agriculture Census acquisition process, particularly by displaying some key data about the process itself. Data are constantly updated and provide a real-time overview of the main figures describing the acquisition process. These figures can be freely and constantly accessed by both Census operators and conventional web users, thus obtaining a high degree of timeliness and transparency on the overall process. The widgets' update is based on a sophisticated data decoupling mechanism, specifically designed to avoid the acquisition system's overloading and partially inspired by data warehousing methodologies.

1 The Web and the Statistical Data Life Cycle

The web is increasingly becoming a fundamental means for supporting several phases of the statistical data life cycle, particularly data acquisition and dissemination [6], and several products are currently available (even as open source software [1]) to support statistical offices in many common activities. However, little interest has been devoted so far to use the web for publicly monitoring the acquisition process itself, thus providing an effective feedback to respondents, and more generally to users.

In this paper we illustrate the main features of a collection of so-called *web widgets*, that were developed for monitoring the 2010 Italian Agriculture Census acquisition process. A widget is a small web component that can be freely embedded

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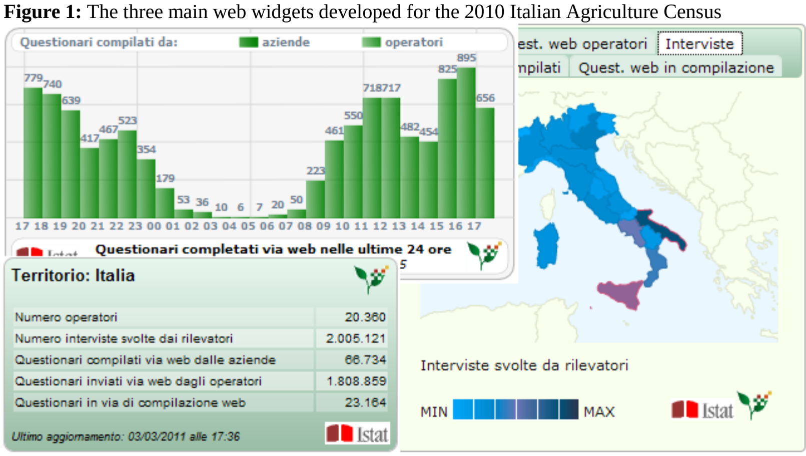
into any web page (e.g. a blog), without requiring specific technical knowledge [5]. Widgets can be composed and organized in personalized dashboards according to the user's specific needs and preferences. The widgets described in this paper display some key data about the Census acquisition process, e.g. the number of Census web questionnaires compiled by enterprises, as well as the hourly distribution of web questionnaire compilations in the last 24 hours (see Figure 1). Data are constantly updated, by providing a real-time overview of the main indicators summarizing the acquisition process. In this way it is the acquisition process itself to become the focus of the statistical analysis and the main data can be freely and constantly accessed by both Census operators and conventional web users, thus obtaining a high degree of timeliness and transparency on the overall process.

In order to avoid the acquisition system's overloading, a sophisticated mechanism was developed, based on decoupling and periodically synchronizing the data accessed by the widget requests from the source data, continuously updated by the acquisition system. In this paper we describe such optimizations, introduced in both the application and data layers, resulting in a good trade-off between scalability and freshness of the provided information.

Figure 1: The three main web widgets developed for the 2010 Italian Agriculture Census



Data shown in the widgets consist of several aggregates focusing on the number of questionnaires and interviews completed. Each widget provides a different perspective of the aggregates, particularly according to the territorial and temporal dimension. The three main widgets are shown in Figure 1 and described in the following.

- The "General picture" widget (bottom left) shows the numeric values of 5 main aggregates at the national level, with the possibility of focusing on a single region.
- The "Regional cartogram" widget (on the right) is organized in 5 tabs, where each tab corresponds to a map of Italy showing the regional detail of each aggregate. When rolling over a region the numerical value of the aggregate pops up.
- The "Latest news histogram" widget (upper left) shows the time distribution of the questionnaires compiled per-hour over the last 24 hours.

2 Decoupling by materializing

The data displayed by the widgets are typically obtained by applying simple aggregations (like counts) on the elementary data, constantly updated by the acquisition process. For the Census this implies in general, as suggested by some values shown in Figure 1, counting several hundreds of thousands of records, while they are being updated by a few thousands of acquisition operators. This may significantly overload the database, resulting in a substantial performance degradation for both the operators working on the acquisition web portal and the users monitoring the acquisition process through the widgets. This potential degradation has been avoided by adapting two techniques, commonly known as *view materialization* and *query rewriting*, widely used in data warehousing environments.

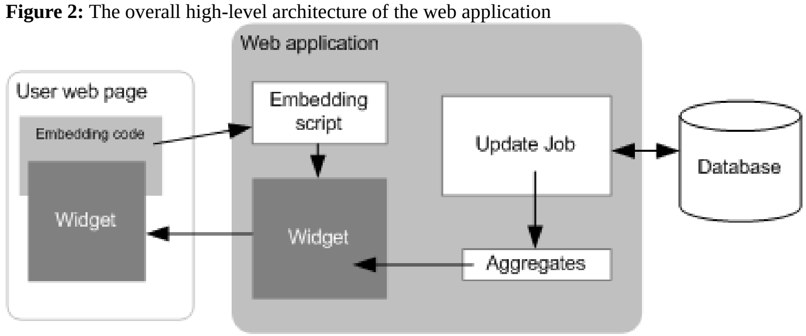
Informally speaking, a materialized view is the combination of a query definition (i.e. the SQL expression of the query) together with the result (i.e. the set of records) obtained by running that query on a given database. The result is typically "refreshed" at predefined time intervals, stored either on permanent storage devices (i.e. the server disks) or in a cache (i.e. in the server RAM). The problem of evaluating the answer to a query by using some materialized (pre-computed) views has been extensively studied in the literature [4]. In the specific context of aggregate queries this is commonly known as (aggregate) query rewriting [2,3]. The term stems from the fact that the original aggregate query (referring to the elementary data) is rewritten into an equivalent one (referring to the views), much faster to be computed. The rewritten query generally combines and/or further aggregates the materialized views (e.g. by summing the regional aggregates to compute a national aggregate). Obviously the price to pay is that the data returned to users are not as "fresh" as they would be, by running queries directly on the elementary data.

3 The widgets' software architecture

The widgets are implemented within a single Java web application, directly accessing the Census database. Considering the fact that the widgets can be freely incorporated into any end-user web site, there is no possibility of estimating what could be the additional load introduced by the widgets on the database, with the risk of interfering with the acquisition activity. Thus, the main criteria driving the design of the application was to realize a solution that could always result in a minimum (and bounded) overhead on the database against unpredictable request traffic.

Figure 2 shows the schema of the general high-level design of the web application. The basic idea is to decouple the access to the widgets by the user from the access to the database. The design is centered on a specific component (referred in the Figure as *Update Job*), whose execution is scheduled to run automatically every minute. The component periodically extracts the aggregates value from the database and stores them in the application memory. Hence, at every user request a widget is rendered only using pre-computed information, without accessing the database.

Figure 2: The overall high-level architecture of the web application



Each widget is implemented as a separate JSP page. The web application includes the code required to embed the widgets into a generic web page. This consists in a single row of HTML code that has to be included in the page (*Embedding code*). This code refers to a JavaScript fragment (*Embedding script*) that creates a frame within which the page rendering the widget is actually loaded. In this way, the widgets can be incorporated into virtually any web site or blog regardless of the underlying technology and without any programming knowledge, at the same time maintaining maximum browser compatibility and a fixed and predictable screen space.

In conclusion, our design can be considered as a general pattern for building embeddable components for the monitoring of an acquisition/production process, where a high level of scalability can be reached at the only price of a delay in the information update. This delay strictly depends on the efficiency of the query execution, motivating the application of optimization techniques based on materialized views. In overall, we showed how combined application- and database-level optimizations allowed us to achieve a good trade-off between scalability and freshness of the provided information. We envision a future application of these ideas within the more severe testbed represented by the forthcoming Population Census.

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Outlier detection via compositional forward search: application to the preliminary data of the 2010 Italian agricultural census

Simona Toti, Filippo Palombi and Romina Filippini

Abstract Compositions are multivariate variables, whose components are strictly positive and can be interpreted as parts of a whole. Each observation comes as a different partition of a given total amount κ, conventionally set to $\kappa = 1$ or $\kappa = 100\%$ in the applications. An example of composition is obtained by fractionating an agricultural fund into areas grown with different crops. Parts of a composition fulfill a sum constraint, which establishes an implicit relation among them. This form of dependency goes beyond the concept of covariance and invalidates the ordinary techniques of the statistical analysis. Outlier detection, for instance, becomes a remarkably entangled problem, due to the ineffectiveness of the Mahalanobis metric as a tool to describe the distance among different compositional vectors. Among the established algorithms for outlier finding in a given data set, the *Forward Search Algorithm* admits an elegant extension to the compositional case. We examine such extension and apply the novel algorithm to the preliminary data of the latest Italian agricultural census.

Key words: Outlier Detection, Compositional Analysis, Forward Search

1 Aitchison distance

Compositional data analysis has been the subject of a number of papers, pioneered by J. Aitchison [1] over the past twenty years. As a methodology of statistical investigation, compositional analysis finds application in all cases where the main object of interest is an n–dimensional variate x, whose components $0 < x_k < \kappa$ $(k = 1, \ldots, n)$ are strictly positive continuous real

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variables to be regarded as portions of a total amount κ, i.e. they fulfill the constraint

$$\sum_{k=1}^{n} x_k = \kappa \,. \tag{1}$$

Examples are easily found in the analysis of geochemical data, balance sheets, agricultural surfaces, etc. Under such circumstances, it may be relevant to consider the x_k's only in terms of their relative importance, i.e. with no reference to their absolute size. If this perspective is adopted, comparing different samples of the variate becomes a matter of comparing one by one all the possible pairwise ratios of their components, since these are the only quantities that bring the relative information. Along this line, Aitchison has introduced an appropriate distance function,

$$d_{\mathrm{A}}(x,y) = \sqrt{\frac{1}{2n}\sum_{i,j=1}^{n}\left[\log\left(\frac{x_i}{x_j}\right) - \log\left(\frac{y_i}{y_j}\right)\right]^2}\,, \tag{2}$$

where all these ratios enter equally weighted, smoothed and symmetrized by logarithms. The Aitchison metric looks different from the more popular Mahalanobis one, as it corresponds to evaluating the distance according to a different criterion. The change of metric makes most classical statistical techniques useless and imposes the introduction of more sophisticated mathematical tools to restore the conditions for a statistical investigation.

2 Forward Search Algorithm

In this conference report we consider the classical problem of a multivariate data set $\mathcal{D}$ containing outliers. Among the various methodologies that can be used to detect and eliminate outlying data, we focus on the one based on the *Forward Search Algorithm* (FSA), originally introduced in [2] and thoroughly discussed in [3] for the case of multivariate analysis. This algorithm applies in the case of normally distributed data and consists of a recursion of sorting operations, where the m^{th} step of the recursion is roughly described as follows:

- sample estimates of the mean $\mu(m)$ and the covariance matrix $\Sigma(m)$ are obtained from a subset $S(m) \subset \mathcal{D}$, made of the first m units of $\mathcal{D}$;
- $\mathcal{D}$ is sorted according to the increasing values of the Mahalanobis distance $d_{\Sigma(m)}(x, \mu(m))$ of the single units x from $\mu(m)$;
- the Mahalanobis distance of the $(m+1)^{\mathrm{th}}$ unit is stored together with the corresponding unit id and defines the m^{th} value of an observed *signal*;

The sorting procedure repeats iteratively until the estimate of the distributional parameters involves all the inliers and the occurrence of the first outlier shows up as a break–point (or a jump) in the values taken by the signal as a function of m. In order to give a quantitative meaning to the break-point and to associate it with an outlier, a statistical test, resting on the normality null hypothesis, is proposed: at each step of the recursion the signal is computed together with the 1% and 99% percentiles of its theoretical probability distribution under H_0. The envelopes of those percentiles surround the signal until an outlier enters the estimate of the distributional parameters. The break–down of the envelopes signals the income of an outlier within $S(m)$. An example of this is discussed later on in this report and is graphically shown in Fig. 1 (see plot d)).

3 Adaptation of the FSA to the compositional case

In order to apply the FSA to a compositional data set, the algorithm has to be properly modified. In first place, it should be realized that the hypothesis of data normality is inappropriate for compositional data, since each component of a given unit x is a strictly positive number. As such, the tails of its marginal distribution can never extend to the negative semi-axis, as would be the case for a normal variable. In fact, Aitchison has shown in [4] that the most natural distributional assumption for compositional data is the log–normal one. Accordingly, the FSA has to be modified in two respects: *(1)* the Mahalanobis distance has to be replaced by the Aitchison distance in the recursive sorting; *(2)* the statistical test, i.e. the construction of the aforementioned envelopes has to take into account the distributional changes in the null hypothesis. A technical description of (*2*) goes beyond the aims of the present report and is detailed in [5].

4 A case study: the 2010 Italian agricultural census

As an example, we apply our compositional FSA to the preliminary data of the sixth Italian agricultural census, held in October 2010. Agricultural holdings are stratified by type of crop within each region of Italy. Here we focus on the province of Alessandria and the local holdings growing three cereals: soft and spelt wheat, barley and corn. Our data set is made of 148 trivariate observations, normalized so that $\kappa = 1$. Inverse fractional parts are shown against each other on a log–log scale in upper and left–lower plots of Fig. 1. Logarithmic scales are needed in order to emphasize data with extremely low values of one or more parts. Out of the 148 observations, the FSA detects 7 outliers, shown as circled points. Right–lower plot of Fig. 1 shows the forward signal and the $\alpha = 0.005$ and $1 - \alpha = 0.995$ over-imposed envelopes at $N = 142$ (see [3] for an explanation of the meaning of the over-imposed envelopes). Though not far from the bulk of the distribution, the

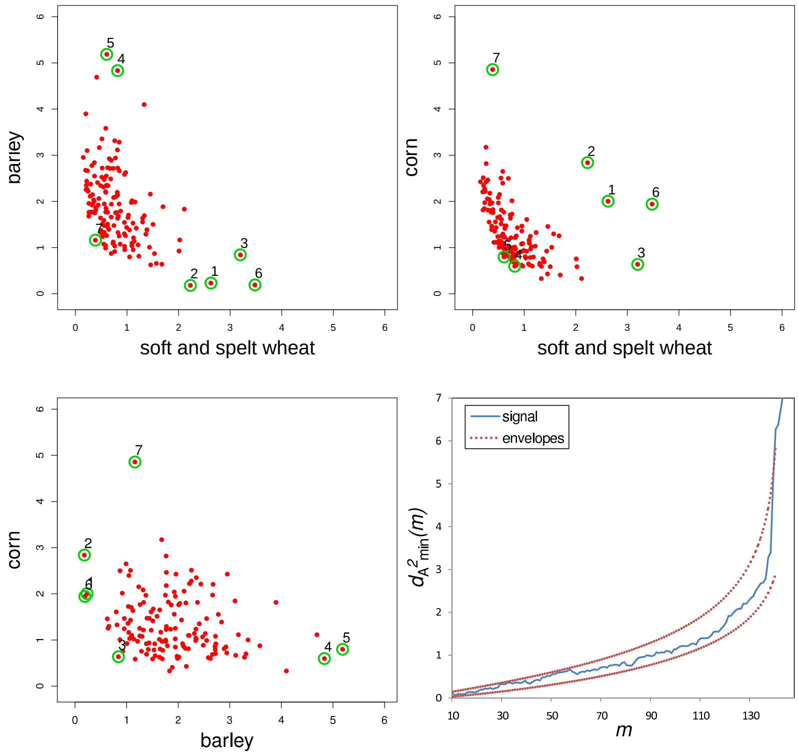

Fig. 1 Results of the compositional FSA on the agricultural data described in Sect. 4.

units marked as outliers are statistically incompatible with the distribution of the remaining data.

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Innovative approaches to census-taking: overview of the 2011 census round in Europe

Paolo Valente

Abstract
In the course of the year 2011, almost all European countries will conduct the population and housing census. About half of the countries in Europe are conducting the 2011 census using an alternative methodology to the traditional census, in most cases for the first time. In general, the alternative methodologies adopted are based on the use of data from registers, either as the only source of census data, or in combination with other data sources. There are also innovative methods that do not make use of registers, like the French "rolling census". This paper discusses the reasons that pushed many countries to consider alternative census methodologies. An overview of the different alternative approaches to census-taking developed in Europe is presented, with an attempt to evaluate the implications in terms of data quality, costs and organization.

1 Introduction

The importance of the population and housing census for national statistical systems.

The population and housing census can be considered as one of the "pillars" of national statistical systems. In fact, the census provides the benchmark for the population count at national and local levels, and yields information on the characteristics of the population at fine levels of territorial detail and for small population groups on which data cannot be collected using sample surveys. Furthermore, the census allows the creation of a solid frame

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that can be used to draw samples for all surveys conducted by the National Statistical Institutes and other relevant statistical institutions (UNECE, 2006).

The population census plays a key role in all countries, from those that developed statistical systems based on data from registers, to those that cannot rely on accurate and complete registers. In countries where vital statistics are not complete and accurate, the census is of vital importance, as it is the only statistical source providing accurate and detailed estimates of the population size and structure.

In July 2005 the United Nations Economic and Social Council (ECOSOC) adopted a resolution on the 2010 World Population and Housing Census Programme (UN-ECOSOC, 2005), in which Member States were urged to carry out a population and housing census at least once in the period 2005-2014, and to disseminate the census results in a timely manner. Similar resolutions were adopted by ECOSOC in connection with previous census rounds.

At the global level, the situation for the 2010 census round seems to be better compared to the 2000 round. The United Nations Statistics Division (UNSD), which is responsible at the global level for the 2010 World Population and Housing Census Programme, released in March 2011 a report (UNSD, 2011) according to which it is expected that by the end of the census round in 2014 at least 227 countries and areas (covering approximately 99 per cent of the world's population) will have conducted at least one census. Only 6 countries or areas have not yet indicated a planned date for their 2010 round census. This is a significant improvement compared to the 2000 census round (covering the period 1995-2004) when 26 countries or areas – mainly in Africa - did not carry out a census.

According to the report by UNSD, in Europe it is expected that virtually all countries will conduct at least one population census by 2014. The large majority of countries in Europe are conducting the census in 2011, which is the reference year for the European census programme (which means that EU member states are expected to conduct their census in 2011). The report also shows that, compared to other continents, Europe stands out for the high number of countries that are conducting the census using data from registers or adopting other methods alternative to the traditional census.

This paper presents an overview of the 2010 census round in Europe, focusing on the census methods used in the different countries. In the next sections, the main census methods are presented, starting with the "traditional census" and the problems that countries may face using this approach. The main alternative census methods are presented in the following sections. For each of them, relative advantages and disadvantages are discussed, together with some implications on census organization, costs, data quality and coverage. Finally, information is presented on which census methods are adopted by the various countries across Europe for the census of the 2010 round, together with a comparison with the methods used for the previous (2000) census round.

2 The traditional census approach

The traditional census: a relatively simple concept but with some shortcomings.

For many years, since the censuses taken in ancient Egypt, the methodology used for the census has been basically the same, consisting of the direct count of all individuals and their characteristics through the completion of population lists or – more recently - census forms. This information is collected in the field across the whole country in a relatively short period of time, normally lasting a few weeks.

In the traditional census there are two alternative methods of enumeration. In the first method the census enumerators are responsible for collecting the information from the households during an interview and completing the forms. This approach is usually adopted in countries with relatively high proportions of minimal education or illiteracy of the population. This method is particularly expensive and requires huge numbers of enumerators, as they have to conduct interviews as well as delivering and collecting the forms.

In the second method, the enumerators deliver the forms to the households and collect them some days later when they have been completed. The forms are filled in by the members of the household, normally by a designated member called the reference person (indicated in some countries as "head of the household"). In some countries where this method is adopted, the postal system is used instead of the enumerators for the delivery and/or collection of the forms.

2.1 Problems associated with the traditional census

Although the concept is relatively simple, the conduction of a traditional census is a huge and very complex operation that requires significant financial resources, the participation of various administrations at the central and local levels, and the recruitment and training of a large work force to be employed on a temporary basis as census field staff (enumerators, supervisors, etc.).

From the point of view of the **census management**, there are a number of problems and issues to be faced when the traditional approach is adopted, including the following:

i) <u>Very high cost</u>: the census conducted in a traditional way is very expensive. The main cost item is for the temporary work force (enumerators, supervisors, etc.) that has to be recruited and trained, and has to work for a few weeks or longer periods. Considering that an enumerator is needed on average for about 100 households (this is a rough estimate, as the real number depends on the characteristics of the census, the territory and other factors), it is clear that the number of persons to be recruited is very high, and so is the cost. Apart from the cost for census field staff, the cost of printing, distributing, collecting a huge number of census forms, entering the data (manually or using scanners) and processing them is also very high. An analysis of data from the 2000 round of censuses conducted by UNECE showed that a traditional census could cost as much as about 20 US dollars per capita in purchasing power parity (ppp) units (United Nations, 2008, pages 39-41).

ii) Not only the very high costs, but also the cost distribution over time and in particular the peak around the period of the fieldwork can create problems for the management of the traditional census.

iii) In many countries, it is difficult to recruit a large number of temporary census staff for the fieldwork operations, taking into account that they must have the necessary skills but can be employed only for a short period.

iv) In many National Statistical Institutes, once the census operations have been completed, it is not possible to retain the staff that worked for the census; they are often reallocated to other services or released. In this case, the knowledge accumulated while planning and conducting the census is lost unless the same staff can be re-employed for the next census.

From the point of view of the **organization of the fieldwork operation**, there are also problems associated with the traditional census, including:

i) The cooperation of various administrations at the national and local level is normally necessary to conduct an operation as complex as the traditional census; this may pose problems in some countries, especially if the budget does not fully cover the census expenses, or if the respective tasks and responsibilities of the various administrations involved are not clearly specified.

ii) There are increasing difficulties to enumerate certain population groups characterized by high mobility and multiple residences (in particular young professionals, students, workers, retired people or other categories who commute regularly between two or more places). In general, it can be difficult to find these persons at home in order to complete the census forms. Moreover, it can be complicated to identify the place of usual residence for these people. A partial solution to this problem is the possibility for the respondents to complete the census forms on the Internet, which is offered as an option by an increasing number of countries.

iii) In many countries, an increasing reluctance of the population to participate in the census has been observed over the last years. This can be due to various reasons, including: reluctance to open the door for security reasons, in particular by old people or in areas with security problems; distrust towards the statistical institutes or more in general the authorities; fear that the information collected could be used for purposes other than the statistical use; reluctance to provide information that is already available in registers or other administrative sources.

Finally, there are also some problems with the **outputs** produced by the traditional census, including:

i) The timeliness of the census results is often an issue at least for certain categories of users of the traditional census, because the results are normally available a relatively long time after the data collection, due to the need to process a huge amount of material and information.

ii) The frequency of the results may also not be sufficient for certain categories of users who need "fresh" data regularly updated: for these users, updates only every ten years are not sufficient.

iii) The information content is limited by the characteristics of the enumeration, in particular when the forms are completed by the respondents. The number of questions and the time necessary to complete the forms must be limited, and questions that may be complex or potentially sensitive for the respondents have to be avoided.

2.2 A variation of the traditional census: the use of long and short forms

In order to address some of the shortcomings of the traditional census, a possible solution exists in using two different forms: a long form is used to collect detailed information from a sample of the population, while a short form is used for the majority of the population, to collect only very general information used for the population count and on the main characteristics of the population. This approach has been used for instance in the United States and Canada since the 1970s.

This method has the advantage of providing extensive information on the characteristics of the population (from the long form), and at the same time reducing substantially the amount of information collected and processed, and limiting the complexity and costs of the census operations. On the other hand, the information present in the long form is available only for a sample of the population, and therefore the information detail is limited both for small areas and for small population groups.

For the 2010 US census, the long form has been replaced by a large household sample survey (the American Community Survey, or ACS) that is conducted every year and provides detailed demographic, social and economic data about households. As a result, the new US census model is based on a decennial traditional enumeration – conducted in 2010 using only a short form – with yearly updates of the population characteristics on a sample basis provided by the ACS.

3 The register-based census

The Nordic approach to census, based exclusively on data from registers.

Starting in the 1970s, some Nordic countries began working on a totally different approach to the census, where the traditional enumeration was replaced by the use of administrative data coming from various registers (population register, cadastre, social security, etc.) through a matching process, in general making use of a personal identification number. This approach, adopted for the first time in Denmark in 1981, permits production of census data at a limited cost and with relatively limited work, once a good quality system of statistical registers has been set up. It should be noted, however, that setting up and maintaining a statistical system based on registers requires important initial investments and a very long development time (UNECE, 2007)). Moreover, this approach requires good cooperation between the statistical institute and the authorities responsible for the registers, an appropriate institutional setting, legislation which allows using register data for statistical purposes and matching records across registers, and finally the acceptance by the public of such a system. All these conditions are met in the Nordic countries, which are going to adopt this approach in 2011.

Apart from the above-mentioned considerations about costs and work required for a register-based census, this approach has the advantage of placing no burden on individuals, and data are potentially available every year. Moreover, there is no cyclic distribution in the costs and census staff, as they are distributed relatively evenly across time.

A disadvantage of this approach is that the characteristics to be collected are limited to those available in the registers, and the quality of the data produced is dependent on the coverage and quality of the registers themselves. Statistical agencies, however, can combine data from different registers to assess and increase quality and derive new variables. Statistical agencies are also dependent on register authorities (see the requirements listed above), but in the Nordic countries in general there is good cooperation. Establishing and maintaining a high quality register-based statistical system requires significant resources and societal will. However, once such a system is set up, it can be used to efficiently produce a wide range of statistics in addition to census data.

4 The “combined census”, based on data from registers and other sources

Many countries have population and other registers that potentially could be used for the census, but the coverage and data quality are not sufficient for complete reliance on these registers to produce census data, or some key census variables are not available. Some of these countries in the last years decided that they can still use register data and integrate them with data from other sources in order to produce the census results. Different approaches to this "combined census" exist, depending on what other data sources are used, and how they are used in combination with the register data. Some of these approaches are presented in this section.

4.1 Combining data from registers and existing surveys

A first approach to the combined census consists in using the results from existing household surveys in combination with register data. An example is the so-called "Virtual census" conducted in the Netherlands in 2001 (and repeated in 2011), where register data are integrated with results from the labour force survey (LFS) in order to produce census data. The Netherlands decided to develop this method because they could not obtain from the registers all the necessary information for some of the economic characteristics. Therefore, information on these characteristics is derived based on results from the LFS.

A necessary prerequisite for implementation of this approach, as for the register-based census, is to link information from different sources at the unit record level. This method is less costly than others as it does not require a specific field phase for the census. This approach also ensures that census results are consistent with survey results for common variables, and there is no respondent burden as households are not required to provide information for the census. However, the processes to successfully link information on individuals from registers and surveys, and to produce information on households are quite complex.

4.2 Combining data from registers and an ad-hoc survey

A variation of the previous approach is to conduct an ad-hoc sample survey for the census and use the results together with data from the registers in order to produce the census results. The ad-hoc survey can be used to evaluate the accuracy of the population or address registers and collect from the sample information on topics that may not be covered in registers, or for which the coverage and quality of registers is not sufficient.

This method was adopted in 2008 by Israel, and other countries (including Belgium, Turkey and Switzerland) are planning to use it in 2011. The method has the advantage of testing the accuracy of the population register and consequently being able to adjust population counts derived from it.

4.3 Combining data from registers and full enumeration

Some countries decided to conduct a census in which the enumeration is based on data from registers, but there is still a full field collection of characteristics on all individuals. This enables variables not available in registers to be obtained in the field as well as providing information about the accuracy of the population count based on registers.

This approach is more expensive than the previous ones (presented in section 4.1 and 4.2) because of the full field enumeration. But it is in general less expensive than a traditional census, because of efficiencies in field operations made possible by the use of register data.

Compared to a register-based census, this method is clearly much more expensive and poses response burden on the public, but on the other hand it provides improved precision of the results and may help improve the coverage and quality of the registers. For this reason, this approach is normally selected for the transition period from a traditional to a register-based census. A significant number of countries in the European Union are using this approach for the 2011 census (see section 6).

5 The rolling census

Some countries do not have population registers, and therefore cannot adopt the methods presented above. Some of these countries, however, have tried to develop alternative approaches to the traditional census without making use of registers. An original and very innovative approach was developed in France and it is known as the “rolling census”. As the name suggests, under this approach the census is conducted as a cumulative continuous (or “rolling”) survey over a long period of time rather than on a particular census reference period.

In France a five-year cycle was adopted for the rolling census, and two different strategies are used for small municipalities (population under 10,000) and large municipalities. Small municipalities are divided into five groups, and a full census is conducted each year in one of the groups. In large municipalities, a sample survey covering 8% of dwellings is conducted each year.

At the end of the five-year cycle, all the population in small municipalities (amounting in France to about half the total population) is enumerated, and about 40% of the population in the large municipalities. In total, about 70% of the country’s population is enumerated. This is enough to guarantee robust information at the level of municipality and neighborhoods, according to the French institute INSEE that developed this method.

The census results are based on rolling averages calculated over the five-year cycle, and are updated yearly. Since the data collection for the French rolling census started in 2004, the first results for the population at the national level were based on data collected in the five-year period 2004-2008 and were referred to 2006, which was the central year of the period.

This method provides for improved frequency of the data, and spreads out across time the financial and human burden associated with the census. On the negative side, the method can be complex to implement. Complications may arise from the movements of persons across municipalities over the various years. These movements could lead to double counting or to missing certain individuals, although specific mechanisms have been clearly put in place to deal with these cases.

6 Overview of census methods used in Europe

In the previous sections, various methodological approaches to the census were presented[2]. But which of these approaches are being adopted by countries across Europe for the census of the 2010 round? In this section information is presented on the method used by European countries for their census. This information derives from a survey conducted in 2010 jointly by UNSD and the United Nations Economic Commission for Europe (UNECE), in order to collect from member countries information on the status of the activities related to the census. The information is presented separately for the countries that are members of the European Union or the European Free Trade Association (EFTA) and for the other European countries that participated in the survey.

6.1 Census methods in European Union and EFTA countries

The data for the 27 EU countries and three EFTA countries (table 1) show that only 11 countries plan to conduct a traditional census in 2011. The remaining 19 countries (over 60% per cent) are adopting an alternative census methodology to the traditional approach.

As the table shows, 13 countries plan to adopt a combined approach, where data from registers will be used in combination with a full field enumeration, or with the results of a sample survey (see section 4 above). Among these countries, the most popular approach seems to be the one where register data are used in combination with a full enumeration (6 countries). As mentioned above, this approach is often adopted by countries that are moving from the traditional census to a register-based census.

Among the other countries with a combined census, data from existing surveys are used together with register data in the Netherlands (where this approach was already adopted in 2001), Iceland and Slovenia. An ad-hoc sample survey is used together with data from registers in Belgium and Switzerland. Finally, two countries (Germany and Poland) plan to

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[2] A more detailed description of the different census methods is described in more detail in (UNECE, 2006), Ch. I and Appendix II. Some examples of implementations of innovative census methods are available on the UNECE website at: http://www.unece.org/stats/documents/2004.11.censussem.htm

combine data from multiple sources, including registers, a full field enumeration and sample surveys.

Five countries (the Scandinavian countries plus Austria and Denmark) will conduct a register-based census, while France is using the rolling census.

Table 1: Census methods and reference dates for EU and EFTA countries

Country	***Census method***	***Reference date***
Austria	Register-based	31 October 2011
Belgium	Combined (registers + survey)	1 January 2011
Bulgaria	Traditional	10 March 2011
Cyprus	Traditional	1 October 2011
Czech Republic	Combined (registers + enumeration)	26 March 2011
Denmark	Register-based	1 January 2011
Estonia	Combined (registers + enumeration)	18 September 2011
Finland	Register-based	31 December 2010
France	Rolling census	1 January 2011
Germany	Combined (registers + enum. + survey)	9 May 2011
Greece	Traditional	16 March 2011
Hungary	Traditional	1 October 2011
Iceland (EFTA)	Combined (registers + survey data)	31 December 2011
Ireland	Traditional	10 April 2011
Italy	Combined (registers + enumeration)	23 October 2011
Latvia	Combined (registers + enumeration)	1 March 2011
Lithuania	Combined (registers + enumeration)	1 March 2011
Luxembourg	Traditional	1 February 2011
Malta	Traditional	November 2011
Netherlands	Combined (registers + survey data)	1 January 2011
Norway (EFTA)	Register-based	19 November 2011
Poland	Combined (registers + enum. + survey)	31 March 2011
Portugal	Traditional	21 March 2011
Romania	Traditional	22 October 2011
Slovakia	Traditional	21 May 2011
Slovenia	Combined (registers + survey data)	1 January 2011
Spain	Combined (registers + enumeration)	1 November 2011
Sweden	Register-based	31 December 2011
Switzerland (EFTA)	Combined (registers + survey)	31 December 2010
United Kingdom	Traditional	27 March 2011

Source: Survey conducted by UNSD and UNECE in 2010 and additional information available to UNECE.

6.2 Census methods in Eastern Europe

If the majority of countries in the European Union have adopted an alternative census methodology, the situation is different in Eastern and South-Eastern Europe, where all countries choose the traditional census approach (table 2). The reason could be that some of the problems associated with the traditional census (see section 2.1 above) do not apply to these countries. For instance, recruiting a large number of temporary census staff could be easier in these countries - compared to countries in Western Europe - thanks to relatively high unemployment, or relatively low labour costs. But there could be also other reasons that make difficult or impossible adopting an alternative census methodology in these countries, like the limited availability of technical or financial resources needed to develop the new census methodology, or the absence of administrative registers of sufficient quality to use the data for census purposes.

Table 2: Census methods and reference dates for countries in Eastern and South-Eastern Europe

Country	*Census method*	*Reference date*
Albania	Traditional	1 November 2011
Belarus	Traditional	14 October 2009
Bosnia and Herzegovina	Traditional	n.a.
Croatia	Traditional	31 March 2011
Montenegro	Traditional	31 March 2011
Republic of Moldova	Traditional	n.a.
Russian Federation	Traditional	14 October 2010
Serbia	Traditional	31 September 2011
The Former Yugoslav Republic of Macedonia	Traditional	31 September 2011
Ukraine	Traditional	2012

Source: Survey conducted by UNSD and UNECE in 2010 and additional information available to UNECE.

6.3 The evolution of census methodology in Europe

Based on the information presented above, it is apparent that in Europe almost half of the countries (19 out of 40 for which information is available) are conducting the census of the 2010 round using an alternative methodology to the traditional census. The majority of them (13 countries) are conducting a combined census using data from registers and other sources, five countries are conducting a full register-based census, and France is using its original rolling census.

Although a large number of countries in Europe have adopted an alternative methodology, the traditional census is still the most common method in the region, adopted by 21 countries located mainly in Eastern and South-Eastern Europe.

Figure 1 presents the map of Europe by census methodology adopted by countries for the 2010 census round. This figure shows the geographical patterns that were already described above in this article. The traditional census is the favourite method in all countries in Eastern and South-Eastern Europe, but also in selected EU countries like Ireland, the UK, Portugal, and Luxembourg. The register-based approach is adopted in the Nordic countries and also in Austria. The combined approach is adopted in many countries in Central Europe, and also in Italy and Spain. Finally, France is the only European country where the rolling census is adopted for the 2010 census round.

Figure 1: Methods used by European countries for the 2010 round of censuses

Source: Valente (2010), published by INED.

It is important to note that Europe is the only continent in the world where a significant number of countries conduct the census adopting an alternative methodology to the traditional census. In the rest of the world, virtually all countries use the traditional approach with only a few exceptions, mainly in Asia (registers are used in Bahrain, Israel, Singapore and Turkey).

As already mentioned, the combined approach is often adopted as a transitional method by countries that are planning to move from the traditional census to a future register-based census. In order to see how countries are moving across time from one method to the other, table 3 presents the distribution of European countries by census method adopted in the 2000 and 2010 census rounds.

The cells with grey background along the main diagonal show that the majority of countries are adopting for the 2010 round the same census method as in the 2000 round: the traditional census in 20 countries, the combined census in six and the register-based census in three countries. The fact that the six countries that adopted the combined approach in the 2000 census round are still adopting this approach in the 2010 round and have not moved to a register-based census can be explained by the long development time necessary for a register-based statistical system to be used for the census.

Out of the 27 countries that conducted a traditional census in the 2000 round, seven are moving for the 2010 round to an alternative method: it's the combined census for five countries (Czech Republic, Estonia, Italy, Lithuania and Poland), the register-based census for Austria and the rolling census for France. Austria passed directly from a traditional census in the 2000 round to a register-based census in the 2010. This can be considered as a relatively unusual change, but in fact Austria has been working towards the register-based census since long before the census of the 2000 round.

The data presented in table 3 also show that four countries that did not conduct the census in the 2000 round will conduct a census in 2010. Two of them (Germany and Iceland) will conduct a combined census, and one (Sweden) a register-based census.

Table 3: Distribution of European countries by census method used in 2000 and 2010 census rounds

Census method					
In 2010 / ***In 2000***	*Traditional*	*Combined*	*Register-based*	*Rolling*	***Total***
Traditional	20	5	1	1	27
Combined		6			6
Register-based			3		3
No census	1	2	1		4
Total	**21**	**13**	**5**	**1**	**40**

Conclusions

With regard to census methodology, Europe can be considered as the world's laboratory, since it is the only continent where a significant number of countries develop and adopt alternative methods to the traditional census. Compared to the 2000 round, there is a clear increase in the number of European countries adopting alternative census methods: from nine in the 2000 census round to 19 in the 2010 round. Moreover, very innovative approaches are developed, like the French rolling census. This trend can be explained by the various shortcomings associated with the traditional census, in terms of costs, management, organization and characteristics of the census outputs.

Notwithstanding the trend towards alternative methods, the traditional census is still the most common approach in Europe. Probably the traditional census will continue to be the best method for many countries in the years to come, in particular in Eastern and South-Eastern Europe. In fact, although many countries are moving from the traditional census to alternative methods that make use of registers, this is not necessarily the way to go for all countries. In fact, every method has its strengths and its weaknesses and there is no perfect solution that fits all countries, as there is no perfect and error-free census.

Each country needs to decide what will work best in its own context, considering all relevant factors. The most important issue is the quality of the output and its appropriateness for the uses to which it is put. It is also important that each country clearly defines the method it uses, evaluates the quality of the census results through established methodologies, and informs the users in a transparent way of possible weaknesses in the data.

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GDP Density Disparities in Old Europe: Theil Decomposition in Cross-Country Historical Perspective

Erasmo Vassallo

Abstract The political, social and economic aspects of Old Europe have experienced profound changes over the last century. The levels and variations of GDP provide a good, though partial, representation of these changes with specific reference to the economic development. According to historical data, GDP shows strong increases in Europe; among these countries also Italy. But, what can we say about the cross-country income inequality? In this paper, we analyze cross-country disparities of GDP density from 1870 to 2008 in fourteen western European countries. In particular, we use a Duro-Esteban decomposition of the Theil index to identify the separate contribution of GDP per capita and population density to the inequality; the correlation of these two components and the changes over time appear interesting also for the implications of the growth theory.

Key words: GDP density; Theil decomposition; Cross-country inequality.

1 Introduction

In the nineteenth century, the second industrial revolution brings significant technical innovations mainly in the chemical and electrical industries. In this period, technological progress gives a major role to human capital that contributes to the demographic transition with a progressive reduction in mortality and fertility and significant increases in productivity and living conditions: the Malthusian trap is finally broken and income grows rapidly (Maddison, 1997). This contributes to the emergence of a strong cross-country inequality. In this paper, we aim to analyze the historical period from post-Malthusian stagnation (roughly in the last decades of the nineteenth

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century) to present-day with specific attention to disparities within Europe and the position of Italy. For this goal, we use the Maddison's historical estimates on GDP and population in the years from 1870 to 2008 for which most western European countries (so-called Old Europe) are available: Austria, Belgium, Denmark, Finland, France, Germany, Italy, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland, United Kingdom; data of Greece, Iceland and Ireland are missing (Maddison, 2010). For these 14 countries considered at current boundaries, we explore cross-country disparities in GDP density, i.e. a measure of economic activity by area, through an unweighted Theil index according to the Duro-Esteban approach (Duro and Esteban, 1998; Bracalente and Perugini, 2008). Therefore, the Theil index of GDP density is decomposed in a Theil index for GDP per capita (GDP per population), a Theil index for population density (population per square kilometers) and a residual term related to the correlation between GDP per capita and population density. In last, specific attention is paid to Italy.

2 Additive Decomposition of the Theil Index

We suppose $\mathbf{x} = (x_1, x_2, ..., x_n)$ with mean m is a vector of GDP per square kilometers, i.e. GDP density, of $n = 14$ western European countries. The cross-country unweighted version of the Theil inequality index is $T(\mathbf{x}) = (1/n)\sum_i^n \ln(m/x_i)$. We prefer to use an unweighted index to give equal importance to countries regardless of their economic or demographic size. We suppose $\mathbf{x}_a \equiv$ (GDP per capita) is a vector similar to $\mathbf{x}$ with mean m_a and $\mathbf{x}_b \equiv$ (population density) is a vector similar to $\mathbf{x}$ with mean m_b. Since $\mathbf{x} = \mathbf{x}_a \mathbf{x}_b$, the Theil index of GDP density can be written (Cheng and Li, 2006)

$$T(\mathbf{x}) = (1/n)\sum_i^n \ln\left(\frac{m_a}{\mathbf{x}_a}\frac{m_b}{\mathbf{x}_b}\frac{m}{m_a m_b}\right) = T(\mathbf{x}_a) + T(\mathbf{x}_b) + \ln\left(\frac{m}{m_a m_b}\right) \tag{1}$$

where $T(\mathbf{x}_a)$ is the (unweighted) Theil index of GDP per capita and $T(\mathbf{x}_b)$ is the (unweighted) Theil index of population density. The last term is a residual related to the correlation between $\mathbf{x}_a$ and $\mathbf{x}_b$. In fact, it is

$$\ln\left(\frac{m}{m_a m_b}\right) = \ln\left(\frac{\operatorname{cov}(\mathbf{x}_a, \mathbf{x}_b)}{m_a m_b} + 1\right) \tag{2}$$

Therefore, the residual term is positive/negative if the correlation is positive/negative; the residual is zero if correlation is zero.

3 Disparities in Old Europe

There are many well-known criticisms of GDP as a measure of development. However, GDP density seems the best way to represent the economic activity in a country (Gallup *et al.*, 1999). The coefficient of variation (CV) of GDP density among the 14 European countries is decreasing over time but high (0.9494 in 1870 and 0.7855 in 2008). The ranking of Italy is stable, 5th in 1870 and 6th in 2008, and it is similar for population density, 4th in 1870 and 5th in 2008, with a CV always around 0.72. For GDP per capita, CV ranges from 0.3455 in 1870 to 0.1408 in 2008, but the positioning of Italy gets worse: 9th in 1870 and 12th in 2008. Table 1 lists the index numbers in some years relative to 1870 (base=100) of GDP density, GDP per capita and population density for Italy. We note in Italy like in Europe that GDP increases strongly after World War II. At the same time, the income inequality is reduced quickly. As a rule, the income inequality in Europe has fallen although the countries have maintained their relative positions. Table 2 shows in some years from 1870 to 2008 the decomposition of the Theil index for GDP density into a Theil index for GDP per capita, a Theil index for population density and a residual term.

Table 1: Index numbers (Italy, 1870:100)

	GDP density	GDP per capita	Population density
1870	100.00	100.00	100.00
1890	126.42	111.21	113.68
1910	203.96	155.53	131.14
1930	284.63	194.59	146.27
1950	394.50	233.56	168.91
1970	1247.20	648.18	192.42
1990	2213.74	1088.01	203.47
2008	2768.54	1327.86	208.50

Table 2: Theil decomposition

	GDP dens.	GDP per c	Pop. dens.	Res. term	Res. sign
1870	0.656	0.058	0.427	0.171	+
1890	0.666	0.065	0.429	0.172	+
1910	0.651	0.061	0.443	0.146	+
1930	0.589	0.060	0.429	0.100	+
1950	0.538	0.079	0.421	0.038	+
1970	0.492	0.034	0.424	0.034	+
1990	0.439	0.013	0.419	0.007	+
2008	0.426	0.011	0.420	-0.005	-

Table 3: Some country effects

	GDP density		GDP per capita		Population density		Residual	
	1870	2008	1870	2008	1870	2008	1870	2008
Denmark	-0,042	-0,032	-0,004	-0,001	-0,027	-0,031	-0,011	-0,001
France	-0,050	-0,029	-0,005	-0,001	-0,033	-0,029	-0,013	0,001
Germany	-0,045	-0,029	-0,005	-0,001	-0,019	-0,025	-0,021	-0,003
Italy	-0,051	-0,033	-0,003	0,000	-0,027	-0,030	-0,021	-0,002
Switzerland	-0,050	-0,030	-0,004	-0,001	-0,033	-0,031	-0,014	0,002
Theil/resid.(overall)	0,656	0,426	0,058	0,011	0,427	0,420	0,171	-0,005

The Theil index of GDP density is explained in small part by inequalities in GDP per capita (8.9% in 1870 and 2.7% in 2008); the inequality in population density has a major role with shares of 65.1 per cent in 1870 and even 98.6 per cent in 2008, while the residual term reduces greatly its influence from 26.0 per cent in 1870 to -1.3 per cent in 2008. In fact, the correlation between GDP per capita and population density is decreasing from 0.76 in 1870 to about zero in 2002; from 2003 to 2008 the correlation is weak but still negative. This means that since 2003 GDP per capita and population density do not move in the same direction: the population growth is reduced but, primarily, GDP grows less (sometimes decreases) in Europe like in Italy. If we repeat calculations eliminating one country at a time, we get results quite similar. Table 3 reports in some country with GDP density close to Italy, the difference between Theil value or residual obtained including all countries and the corresponding term obtained removing that specific country. Italy has a difference, or contribution to the GDP density inequality, equal to -0.033 in 2008. Hence, if we exclude Italy, we will have a higher Theil index for GDP density, 0.426-(-0.033)=0.459 in 2008, determined largely by the contribution of population density (-0.030) while the contribution of GDP per capita and residual is negligible unlike the late nineteenth century. We note that Theil values on 13 countries (eliminating one country at a time) and the overall Theil index on all countries are not strictly comparable, but if we understand the overall Theil as a generic and common point of comparison, the simplification is valid and useful for our purpose. We note also that the exclusion of Italy, rather than any other country, increases a lot the inequality score in Old Europe in most years between 1870 and 2008.

4 Conclusion

GDP in Europe grows especially after the Second World War: 1.49% in 1870-1945 (average annual rate) and 3.27% in 1945-2008 with, respectively, 0.99% and 4.19% in Italy. The growth path of GDP per capita is similar: 0.91% and 2.77% in Europe with 0.33% and 3.78% in Italy in 1870-1945 and 1945-2008 respectively. Growth, however, made especially in the early postwar decades. Basically, the European countries have followed a common path of development which has reduced their income inequalities. The GDP density inequality is reduced since the early 1900's and more intensely after World War II. The GDP per capita inequality is stable until the beginning of the war, then it increases rapidly until 1945 and, finally, it decreases rapidly. The population density inequality remains more or less stable. In particular, the Theil decomposition of the GDP density inequality shows that a large part of the reduction of the European inequality from 1870 to 2008 depends on the weakening of the link between GDP per capita and population density. This is also valid for Italy. Specifically, the correlation between these two factors becomes negative in 2003 and it remains weak and negative until 2008.

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Geometrical Product Specification and Verification: Kriging based Sequential Inspection Plans

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Abstract Manufactured parts are inevitably affected by form and size errors; thus, it is mandatory to construct inspection plans to check the fulfilment of parts to dimensional and geometric specifications. In the paper, a flatness tolerance problem is considered; only few points, outer and inner ones, are relevant in verifying flatness. An algorithm aimed at obtaining a fairly "good" inspection design, that links a reasonable number of points to be probed with an efficient estimate of the flatness tolerance value, is based on the use of Kriging models and on a sequential selection of the points.

1. Introduction

Form and size errors, assessed against dimensional and geometrical tolerances, have an impact on manufactured parts. The flatness tolerance defines a zone between two parallel planes within which a surface must lie [ISO 1101]. An overall inspection of the surface is required as only the most external and inner points are relevant in verifying flatness errors. To overcome these difficulties, we suggest an algorithm based on the use of Kriging models, and on a sequential selection of the points to be probed by the Coordinate Measuring Machines (CMM). The CMMs rationale is peculiar to statistics; they probe only a few points of the part surfaces, i.e. in a sample, and the inspection plan specifies which are the probed points and the probing order, i.e. an experimental design. Section 2 is presents the Kriging model and the uncertainty of Kriging predictions. Section 3 presents the application of an adaptive approach for generating sequential sampling plans, illustrated by a case-study based on real CMM measurements. The paper discusses different approaches: the choice of the correlation function taking into account the technological signature of the surface analyzed, different criteria for selecting the successive inspection point and two different association methods to estimate the flatness error.

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2. Kriging modelization

In the fifties, Kriging models were extensively used to predict spatial data in geostatistics [2]; recently, their use is advisable to approximate the output of Computer Experiments (CE) [5]. Once more, Kriging models have been adopted in industrial metrology to drive the online construction of sequential designs to inspect industrial parts on CMM [3] because of their recognized ability to provide good predictions. The Kriging model considers the response $y(\mathbf{x})$, $\mathbf{x} \in \mathcal{X}_d \subset \mathbb{R}^d$, as a realization of a Gaussian random process $Y(\mathbf{x})$:

$$Y(x) = \boldsymbol{f}'(\mathbf{x})\boldsymbol{\beta} + Z(\mathbf{x}) \tag{4.1}$$

where $\boldsymbol{f}(\mathbf{x}) = (f_1(\mathbf{x}), f_2(\mathbf{x}),\ldots, f_m(\mathbf{x}))'$ is a set of specified trend functions, $\boldsymbol{\beta} = (\beta_1, \beta_2,\ldots, \beta_m)'$ is a set of (usually unknown) parameters and $Z(\mathbf{x})$ is Gaussian random process, with zero mean and stationary covariance over the design space $\mathcal{X}_d \subset \mathbb{R}^d$, i.e. $\mathbb{E}[Y(\mathbf{x})] = 0$ and $\mathrm{Cov}(Y(\mathbf{x}), Y(\mathbf{x}+\mathbf{h})) = \sigma_Y^2 R(\mathbf{h}; \boldsymbol{\theta})$, where σ_Y^2 is the process variance, R is the Stationary Correlation Function (SCF) depending only on the displacement vector $\mathbf{h}$ between any pair of points in $\mathcal{X}_d$ and on a vector parameter $\boldsymbol{\theta}$. The most popular choice for the correlation function among the practitioners of CE is within the power exponential family. However, we favour the use of the *variogram* (4.2) because it is very informative about the random process $Z(\mathbf{x})$ much as the pioneers of the Kriging models in geostatistics do for predicting noisy spatial responses from a generally small number of observations [1], a rather different situation to a CE:

$$2\gamma(\mathbf{x}_1 - \mathbf{x}_2) = \mathrm{Var}[Z(\mathbf{x}_1) - Z(\mathbf{x}_2)] \qquad \text{for all } \mathbf{x}_1, \mathbf{x}_2 \text{ in } \mathrm{X}_d \tag{4.2}$$

A natural estimator of the variogram based on the method of moments under the assumption that $\mathbb{E}[Z(\mathbf{x})] = 0$ is:

$$2C(\mathbf{h}) = \frac{1}{\# N(\mathbf{h})} \sum_{N(\mathbf{h})} \left(Z(\mathbf{x}_i) - Z(\mathbf{x}_j)\right)^2 \tag{4.3}$$

where $N(\mathbf{h}) = \{(\mathbf{x}_i, \mathbf{x}_j) : \mathbf{x}_i - \mathbf{x}_j = \mathbf{h}; i, j = 1,2,\ldots,n\}$ and $\#N(\mathbf{h})$ is the number of pairs $N(\mathbf{h})$ that are distinct. If the variogram depends only on length of vector $\mathbf{h}$, then the stochastic process underlying the variogram is isotropic; conversely, the process is anisotropic. Isotropic processes form an inadequate basis in modelling when the monitored manufactured parts show a technological signature. In the case study (Section 3), the estimated variogram showed different trends along the two axis directions; therefore, exponential correlation functions with different parameters for both the smoothness and the scale have been considered.

In Section 3, we assume that no a-priori knowledge on the surface error is available to drive its choice; therefore, we consider the *ordinary* Kriging model where the trend is constant even if unknown, i.e. $\boldsymbol{f}'(\mathbf{x})\boldsymbol{\beta} = \beta$, without suffering losses in prediction fidelity [5]. For the prediction of the response $Y(\mathbf{x}_0)$ at an untried point $\mathbf{x}_0$, we resort to Bayesian estimators; the prior information on the set $\mathbf{Y}^n = (Y(\mathbf{x}_1), Y(\mathbf{x}_2),\ldots, Y(\mathbf{x}_n))'$ of field variables at $\mathbf{x}^n = (\mathbf{x}_1, \mathbf{x}_2,\ldots, \mathbf{x}_n)$ is used for predicting the unknown output $Y(\mathbf{x}_0)$. Assuming that the distribution of the joint random variable

$\left(Y(\mathbf{x}_0), Y(\mathbf{x}_1), Y(\mathbf{x}_2), \ldots, Y(\mathbf{x}_n)\right)$ is normal and if β is known, the conditional expectation of $Y(\mathbf{x}_0)$ given $\left(Y(\mathbf{x}_1), Y(\mathbf{x}_2), \ldots, Y(\mathbf{x}_n)\right)'$, $\hat{Y}_0 = \mathbb{E}\left(Y(\mathbf{x}_0)\middle|\mathbf{Y}^n\right)$, is the unique predictor and the Best Linear Unbiased Predictor (BLUP) of $Y(\mathbf{x}_0)$:

$$\hat{Y}_0 = \beta + \mathbf{r}_0^{'}\mathbf{R}^{-1}\left(\mathbf{Y}^n - \beta\mathbf{1}\right), \text{ with } \mathbf{1} = (1, 1,..,1)' \tag{4.4}$$

The (4.4) minimizes the Mean Squared Prediction Error (MSPE):

$$\mathrm{MSPE}\left[\hat{Y}_0\right] = \mathbb{E}\left[\left(\hat{Y}_0 - Y(\mathbf{x}_0)\right)^2\right] = \sigma_{\zeta}^2\left(1 - \mathbf{r}_0'\mathbf{R}^{-1}\mathbf{r}_0\right) \tag{4.5}$$

(4.5) is a measure of uncertainty of predictions: it is large when $\mathbf{x}_0$ is away from the experimental points, small when it is close to them and it vanishes at the experimental points, due to the interpolatory property of Kriging. However, equation (4.5) holds only if β and $R(\mathbf{h};\boldsymbol{\theta})$ are known, which is unlikely in an experimental setting. If β has to be estimated, the BLUP is given by (4.4) with β replaced by its generalized least squares estimator $\hat{\beta} = \left(\mathbf{1}'\mathbf{R}^{-1}\mathbf{1}\right)^{-1}\mathbf{1}'\mathbf{R}^{-1}\mathbf{Y}^n$. Hence, the Kriging variance (4.5) is larger because of an additional uncertainty component:

$$\mathbb{E}\left[\left(\hat{Y}_0 - Y(\mathbf{x}_0)\right)^2\right] = \sigma_{\zeta}^2\left(1 - \mathbf{r}_0'\mathbf{R}^{-1}\mathbf{r}_0 + \mathbf{c}_0^{'}\left(\mathbf{1}'\mathbf{R}^{-1}\mathbf{1}\right)^{-1}\mathbf{c}_0\right) \qquad \text{with } \mathbf{c}_0 = 1 - \mathbf{1}'\mathbf{R}^{-1}\mathbf{r}_0 . \tag{4.6}$$

The unknown parameter vector $\boldsymbol{\theta}$ in $R(\mathbf{h};\boldsymbol{\theta})$ was estimated by maximum likelihood. The predictor obtained by plugging the estimates $\hat{\mathbf{r}}_0 = \mathbf{r}_0(\hat{\boldsymbol{\theta}}_{\mathrm{ML}})$ and $\hat{\mathbf{R}} = \mathbf{R}(\hat{\boldsymbol{\theta}}_{\mathrm{ML}})$ into (4.6) is named Empirical BLUP and (4.6) underestimates prediction variance as it doesn't account for the extra variability transmitted to $\hat{\mathbf{r}}_0$, $\hat{\mathbf{R}}$ and $\hat{\beta}$ by $\hat{\boldsymbol{\theta}}$. The *nugget effect* on SCF, to prevent the interpolatory of Kriging, is indeed very small in our application and could safely be not considered.

3. Flatness error estimation: the Case Study

A planar surface has been measured by means of a CMM; a preliminary large point sample (500 points) was inspected, so the computed flatness error may be considered a fairly good approximation of the true one. According to ISO standards, two different association methods have been used to estimate the flatness error: the Least Squares (LS) and the Minimum Zone (MZ). The LS approach estimates the parameters of the least square plane by fitting a reference model (or ideal feature) to the sampled data set; the distance of each point of the data set from the estimated plane (residuals) is computed and the sum of the highest and lowest value provides the estimated flatness error. The MZ method compute the equations of two parallel planes with the constraints of enclosing all the sampled points and of minimizing their distance.

In a sequential design approach, the points to be sampled are adaptively selected at each run relying on the information acquired from the data up to that time. In this paper, the start design was a 4 LH design plus the 4 point at the vertices (the size n_0=8 is a reasonably low number of data needed to estimate the unknown parameters). The uncertainty of Kriging predictions was considered in the choice of both the initial inspection design [3], and the selection of the subsequent points to inspect; moreover, the extremes points of the domain are included in the initial set of design points in order to avoid extrapolation when predicting. Based on the initial set of points, the experimental design is iteratively built up by adding one point at a time according to a specific criterion and the next design point is selected among a set of candidate points located on a uniformly spaced and *tight* rectangular grid, a regular rectangular lattice $\mathcal{X}_d = \{1, \ldots, l\}^2$). Criterion for the next point selection can be based on the MSPE (4.6) of the Kriging model estimated by means of the already measured points and/or on the basis of the increasing flatness error evaluation. The criterion based on MSPE leads to a refinement in the Kriging model predictions; whereas the specific criterion based on flatness error leads to an increase in the flatness error evaluation, that may however be biased by a non-refined Kriging modelization. The two criteria may be used individually or combined according to different rules. In the paper, two rules have been considered. According to the former criterion, named Δ-MSPE criterion, the point with the maximum flatness error increase, if there is an increase, is selected. Otherwise the point with the maximum MSPE is selected, i.e. a refined model is preferred. The latter is referred to as Δ-MSPE *average.* The point with the maximum flatness error increase, if there is one, is selected given that its MSPE is less than the average MSPE (with respect to the whole set of points), otherwise the point with the maximum MSPE is selected. After the *winning* candidate point has been selected, the measurement is performed at this new site and the point becomes part of the current dataset. Then, the Kriging correlation function is estimated by Maximum Likelihood based on the current dataset and the new Kriging model is now used to provide new predictions. It is worthwhile to point out that, as the predictions are inexpensive, it is possible to predict over a convenient *tight* grid. Finally, the estimate flatness error is computed by applying LS or MZ methods to the large point sample, comprising both the current experimental points and the new predictions.

The method with MZ association criterion computes the flatness error very accurately in only 15 iterations (i.e. 23 sampled points in all), both using only the set of measured points and using points estimated with the Kriging model. The LS method overestimates the flatness error if sampled points are used; a more precise evaluation can be obtained in few iterations if the flatness error is computed using the whole set of data (predicted and measured points). According to these results the adaptive sampling strategy using the Kriging method seems to be a promising approach to evaluate the flatness error, given that both using LS and MZ it is possible to obtain the tolerance error in few iterations. We did not apply any stopping rule, even if it could be useful in a different experimental context. However, a generalized stopping rule might not be suitable for all possible types of surface deviations due to different manufacturing processes.

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3 June 2011

Gender and social relationships: advancing knowledge for policymaking

Andres Vikat[1]

Abstract

Social science regards gender as a socially and politically constructed concept that is a central organizing principle of all social relationships. This includes the relationships between women and men, the relationships between generations, the organization of families, networks of people, education and work, as well as preferences and values. Recent changes in all these domains have significant repercussions for society and pose challenges to public policy.

Official statistics are among the important sources of information on the changes and their repercussions, and for designing and monitoring policy. The United Nations Economic Commission for Europe (UNECE) has been implementing a multi-year programme on engendering national statistical systems, has provided methodological and training material and is hosting a statistical database on gender issues. To improve understanding of the developments and to have a possibility to capture causal links, analysis of behavioural mechanisms at the micro-level of individuals and households is also required, preferably in an internationally comparable manner. In response to such analytic needs, UNECE has launched the Generations and Gender Programme.

The paper highlights some examples from the UNECE Gender Statistics Database and the Generations and Gender Programme and argues for strengthening international cooperation in statistics and research.

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Gender in internationally agreed policy objectives

Social science research regards gender as a socially and politically constructed concept that is a central organizing principle of all social relationships. This includes the relationships between women and men, the relationships between generations and the organization of families, networks of people, education, and work, as well as preferences and values. In fact, all human development and human rights issues have gender dimensions, and this implies that gender aspects need to be taken into account in all policymaking related to society and people.

There is consensus that participation and partnership of both women and men are required for a productive and reproductive life, including shared responsibilities with respect to care for family members and the maintenance of the household. At the same time, the majority of those with caring responsibilities are women. It is also acknowledged that the increase in women's labour market participation has not prompted an increase in men's domestic duties – what is frequently referred to as women's dual burden. From the point of view of achieving gender equality, public policy needs to include measures counteracting women's marginalization in professional activities and in social protection systems.

Indeed, gender equality is a desirable policy goal, proclaimed at high-level international forums and elaborated in internationally agreed policy objectives. These include the United Nations Convention on the Elimination of All Forms of Discrimination against Women (1979) and the Platform for Action of the Fourth World Conference on Women held in Beijing in 1995. Gender equality is also a fundamental component of the Millennium Development Goals adopted by all Member States of the United Nations in 2000. Among them, goal 3 explicitly calls for gender equality and the empowerment of women, with the associated indicators relating to education, employment and decision-making. However, ensuring gender equality is essential for achieving all the other goals and countries are asked to provide sex-disaggregated data wherever applicable when reporting on progress. Furthermore, gender equality and empowerment of women are central components of the Programme of Action of the International Conference on Population and Development (1994) and the Madrid International Plan of Action on Ageing (2002). Since 2006, the United Nations General Assembly has passed several resolutions on strengthening measures to eradicate violence against women and on improving the measurement of this phenomenon. The European Union has undertaken many initiatives in the follow-up to these global policy objectives.

Gender issues have thus remained high on global and regional policy agendas and in the programmes of international organizations over the recent decades. Beside the call for policies on the advancement of women and gender equality, the internationally agreed documents are also explicit on the need for statistics and research to base these policies on appropriate evidence.

The United Nations regional commissions are supporting countries' efforts in implementing these globally defined policy objectives through international cooperation that considers regional specificities. The United Nations Economic Commission for Europe (UNECE) that includes 56 countries in Europe, North America and Central Asia has been among the forerunners in advancing gender statistics, that is, statistics that reflect the realities of the lives of women and men and policy issues relating to gender equality. It is also coordinating data collection for research on a broad range of gender issues and supporting the mainstreaming of gender into economic policies. This paper shows examples of the statistics and research on gender issues resulting from UNECE programmes and argues for strengthening international cooperation in this regard.

International cooperation in gender statistics

For an evidence-based policy, one needs to measure the situation and processes that the policy is targeting. As gender issues are pursued in national and global agendas, policymakers, researchers and people advocating for gender equality request more information and data. This requires that the gender perspective be considered among the guiding principles for data collection and analysis. Furthermore, it encourages statistical systems to produce more information on gender issues and provide data disaggregated by sex wherever appropriate. This is necessary, because in addition to the policies that target gender equality, many areas of social and economic policy are affected by gender dimensions and need to rely on information on women and men.

Since the mid-1980s, UNECE has been providing a sustainable platform for methodological work and exchange of good practice in gender statistics. The recently published comprehensive manual[2] on this topic is one good example where joining forces from many countries with rather different social and economic situations can be successful, resulting in an authoritative reference material. Governed by the Conference of European Statisticians (the UNECE committee on statistics) and its Bureau, current UNECE work on gender statistics is coordinated by the Steering Group on Gender Statistics that includes representatives from eight national statistical offices and five international organizations. It advises on the organization of meetings and workshops and on the establishment of task forces to tackle specific methodological tasks.

The biannual UNECE work sessions on gender statistics have been reviewing ways of measuring progress towards gender equality for a quarter of a century. These three-day work sessions provide a forum for member countries to exchange experience, to bring up methodological issues that need to be tackled at the international level and to identify emerging new issues. For example, the 2010 work session[3] brought together gender statistics focal points from 30 countries and 6 organizations. It discussed the measurement of gender differences in economic security, including the gender pay gap, population censuses as an information source for gender issues, new information needs on emerging patterns in gender-specific responses to the economic crisis, new on-line and interactive web tools for disseminating gender data, and results from recent time use surveys.

For future work, the session recommended to identify key gender indicators related to internationally agreed policy goals and to develop a framework for grouping indicators by domains and a hierarchy of indicators. This has led to the establishment of a new Task Force on Indicators of Gender Equality, which aims to develop a framework for grouping the indicators by domain and structuring them into headline and supporting indicators, and to propose measurement approaches where internationally consistent measures are lacking.

[2] United Nations Economic Commission for Europe, World Bank Institute. *Developing gender statistics: a practical tool*. Geneva: United Nations, 2010. http://live.unece.org/index.php?id=17450.
[3] http://www.unece.org/stats/documents/2010.04.gender.htm

The Task Force on Gender-based Violence has guided the development of a survey module[4] designed for collecting data on the indicators agreed upon by United Nations Statistical Commission. The module is expected to become a standard data collection tool on violence against women for national statistical offices worldwide. It is currently being tested in different regions of the world.

Developing capacities in gender statistics in countries of Eastern and South-eastern Europe, Caucasus and Central Asia has been another important role of UNECE. In a joint programme with the World Bank, UNECE has developed training modules consisting of multimedia presentations and practical exercises for use in training events. Training videos[5] on 13 key topics in gender statistics are currently available in English and Russian. Over the recent years, these tools have been widely used in many sub-regional and national training workshops. The demand-driven workshops have brought together producers and users of statistics to discuss and learn how to engender a national statistical system, to strengthen sub-regional and national networks and to support development of national action plans. All in all, this has resulted in the increased availability of information about the situation of women and men in those countries.

UNECE Gender Statistics Database

The increased availability of data is illustrated in the UNECE Gender Statistics Database[6] that provides easy access to policy-relevant indicators on gender issues. Consolidating this information for the entire UNECE region that embraces North America, Europe and Central Asia adds important value in comparing gender issues across countries with very different development levels and cultural background, as data on countries of Eastern Europe and Central Asia are often unavailable in other international data collections. This Database was launched in 2003 and is available in English and Russian. The PC-Axis platform of the Database provides users much flexibility in customizing their queries and downloads.

The topics covered in the Database include population, fertility, families and households, work and the economy, education, public life and decision-making, health and mortality, crime and violence, science and information and communication technology, and work-life balance. National statistical offices supply most of the data. Where available, sources from other international organizations are used. In the following, some examples on employment and women’s economic empowerment are provided.

Although women’s labour market participation in the UNECE region has increased in recent years and is the highest in the world, it remains significantly lower than that of men, because family responsibilities and especially childcare can exert a significant constraint on women’s participation in the labour force. However, gender equality in the economy is not only a matter of equal access to the labour market, and of equal opportunities to access decent jobs. Entrepreneurship is also an important pillar for women’s economic empowerment. Setting up their own business can be a good opportunity for women to gain economic independence and overcome poverty. Women entrepreneurs are known to provide an important contribution to

[4] http://www1.unece.org/stat/platform/display/VAW
[5] http://www.unece.org/stats/video
[6] http://w3.unece.org/pxweb

sustaining economic growth, job creation and to improving the living standards of their families and communities.

It is well known that so far, far fewer women than men run a business in the UNECE region. The highest proportions of women among employers — above 30 per cent — can be found in the Russian Federation, Kazakhstan, the Republic of Moldova and Ukraine. In all those countries, women slightly increased their share over the last decade. In most European Union countries and in South-Eastern Europe, the percentage of women among entrepreneurs has stagnated between 20 and 30 per cent (figure 1). Women's success as entrepreneurs depends on a supportive society that promotes their full and equal participation in the public sphere. This starts with equal access to education, and continues with providing women with equal opportunities in paid work and economic and public decision-making.

Men do indeed earn more from employment than women do (figure 2). Gender pay gap indicators offer a synthesised view of these differences, but can also convey a variety of interpretations depending on the way they are calculated and presented. The figure presents the gap in two common ways. The first relates to differences in the hourly wage rate between male and female employees. This indicator is independent of the number of hours worked by either sex in any sector of economy. It therefore reflects overall inequalities that could stem from factors such as occupation (sector and seniority), qualification, and length of experience. The second measure refers to differences in gross monthly earnings from employment. This is arguably a more accurate indicator of overall gender inequality since it comprises the gender difference in the level of labour market participation, such as full and part-time work. Moreover, the difference between the two measures is a valuable source of information in itself. Looking at the pattern for Azerbaijan, for example, the pay gap is about equally large in both monthly and hourly earnings, which indicates that patterns of full and part-time employment are similar between the sexes. The factors explaining the large gap are thus other than labour market participation. To the contrary, in Poland where the gap is relatively low, up to a third of the disparity could be attributed to differences in labour force participation of men and women.

In contrast to other regions, gender parity in education has practically been reached in the UNECE region. In most countries, women now outnumber men in tertiary education. However, we observe strong gender differences in the educational choices of women and men. Men continue to dominate in the science, mathematics and computing programmes while women dominate in business administration, law, social sciences, journalism, humanities and the arts. These different educational choices contribute to gender segregation in the labour market and persistent gender pay gaps. Engendering education involves progress towards gender equity in the learning opportunities available for both women and men throughout their lives.

One of the areas where women are frequently under-represented is research. In UNECE countries, between 23 and 55 per cent of researchers are women (figure 3). The percentage is particularly high in countries of Eastern Europe, Caucasus and Central Asia where women comprise above 40 per cent of all researchers. In most European countries, the share of women among researchers ranges between 30 and 40 per cent but new member countries of the EU show quite high levels: 55 per cent in Latvia and 47 in Bulgaria. Germany and the Netherlands have 23 per cent of women-researchers, the lowest in the EU. These variations across countries can relate to many factors, such as different gendered preferences in career choice and different relative status of research jobs among other high-qualification jobs.

Research using Generations and Gender Surveys

Official statistics are an important data source for monitoring developments. However, aggregated statistics would allow analyzing societal-level (macro-level) processes and would not reveal the behavioural mechanisms that operate at the micro-level of individuals and households. The latter are also very important for understanding the developments and for designing policies.

In addressing this need, UNECE embarked on the Generations and Gender Programme[7] (GGP), a system of Generations and Gender Surveys and contextual databases, to improve understanding of demographic and social developments and of the factors that influence these developments. It is particularly useful in its ability to analyse central interrelated questions affecting the demographics of our societies, in particular aging, low fertility, delayed early life transitions, changing family forms, the work-life balance, labour force participation, care of dependents and intergenerational relations. Collecting data on both the micro level of individuals and households and macro level of the society, the analyst can disentangle the relative role of individual and social factors, ranging from economic and normative questions to institutional and policy contexts. The gender approach of the Programme allows analyzing gender relations and the way in which differently gendered social systems influence behaviour. Furthermore, the Surveys are longitudinal, which significantly strengthens the explanatory evidence they will provide in the future.

With 17 countries collecting the Generations and Gender Survey data, more and more harmonized micro-data files are becoming available for research.[8] Next to individual-level data, a contextual database including macro-indicators on 60 developed countries can be consulted, and data can be downloaded.[9] Around 500 articles and other publications[10] have used these data. While the amount of research is impressive considering that the micro-data became internationally available in spring 2008, research efforts that fully exploit the potential of these data for comparative analysis of gender issues are yet to appear.

An example of issues that the Programme deals with is the connection between gender equality and fertility. The very low fertility levels in Southern, Central and Eastern Europe could lead to marked population decline and could greatly magnify the challenges posed by population ageing in the future. In population policy reviews, most Governments from these countries regard their fertility levels as too low and are thus expected to find use for measures that could counteract this trend. At the same time, one can observe on the macro level that in the context of low fertility, fertility levels remain relatively high when there are high levels of gender equality in the economy, family and society. A micro level analysis can bring us closer to understanding this relationship and it policy implications.

[7] United Nations Economic Commission for Europe. *Generations and Gender Programme: concepts and guidelines*. Geneva: United Nations, 2007. Available at http://ggp.unece.org

[8] Data of the first panel wave are currently available for Austria, Bulgaria, Estonia, France, Georgia, Germany (including a Turkish sub-sample), Hungary, Netherlands, Norway, Romania and the Russian Federation. The information is updated at www.ggp-i.org.

[9] www.ggp-i.org/contextual-database.html

[10] See the GGP bibliography at www.ggp-i.org/bibliography/bibliography.html

For example, in their study on the relationships between gender equality and fertility, Neyer & Rieck (2009)[11] show how European welfare states have pursued different gender strategies regarding the support which they grant women or men to maintain their own employment, sustain their independent financial resources and alleviate their care obligations or enable their care giving during parenthood. The four countries they study — Bulgaria, France, Germany and the Russian Federation — all represent different approaches in this respect. Over the last decades, the fertility level in France has been high in the European context, the one in Germany low and in Bulgaria and the Russian Federation very low.

France is offering comprehensive childcare to support women's full-time employment, but it also has policies that allow mothers of several children to retreat from the labour market for a longer period. German policies, by contrast, have targeted women as carers and men as earners, providing little childcare facilities for children below age three and providing tax incentives for married women to withdraw from the labour market or reduce their employment. Bulgaria and the Russian Federation represent a rather typical situation for Central and Eastern Europe where the gender and social inequality in labour force participation and in wages increased over the last two decades, whereas in the recent years care leave options have been extended. In the Russian Federation, childcare services were reduced considerably, and cash benefits and private care have been prioritized.

Synthesizing their findings across these different policy contexts, the authors conclude that the availability of childcare and having a job that allows one to maintain a household are essential factors for both women's and men's intentions to have a child, but even more so for women than for men. The latter aspect would therefore not only call for policies that strengthen women's and men's employment and financial situations, but for policies that strengthen women's employment and financial resources vis-à-vis men. It also calls for policies towards improving childcare. At the same time, the authors call into question policy strategies that aim at easing part-time options for women as a route to support transition to parenthood.

Concluding remarks

The kind of statistics and research presented here can emerge as a result of concerted international efforts. First, methodological work is needed to streamline the concepts and definitions and develop data collection methods and tools. Capacities to collect and process the data need to be built in countries where they are insufficient, and common platforms developed to share the results. Recognising that knowledge on gender issues needs to go beyond description of levels and trends, data needs to be collected for internationally comparable research, with crucial contributions from statistical offices. Furthermore, the statistics and research would need to be made available and discussed in the manner that facilitates their use for policymaking on national and international levels.

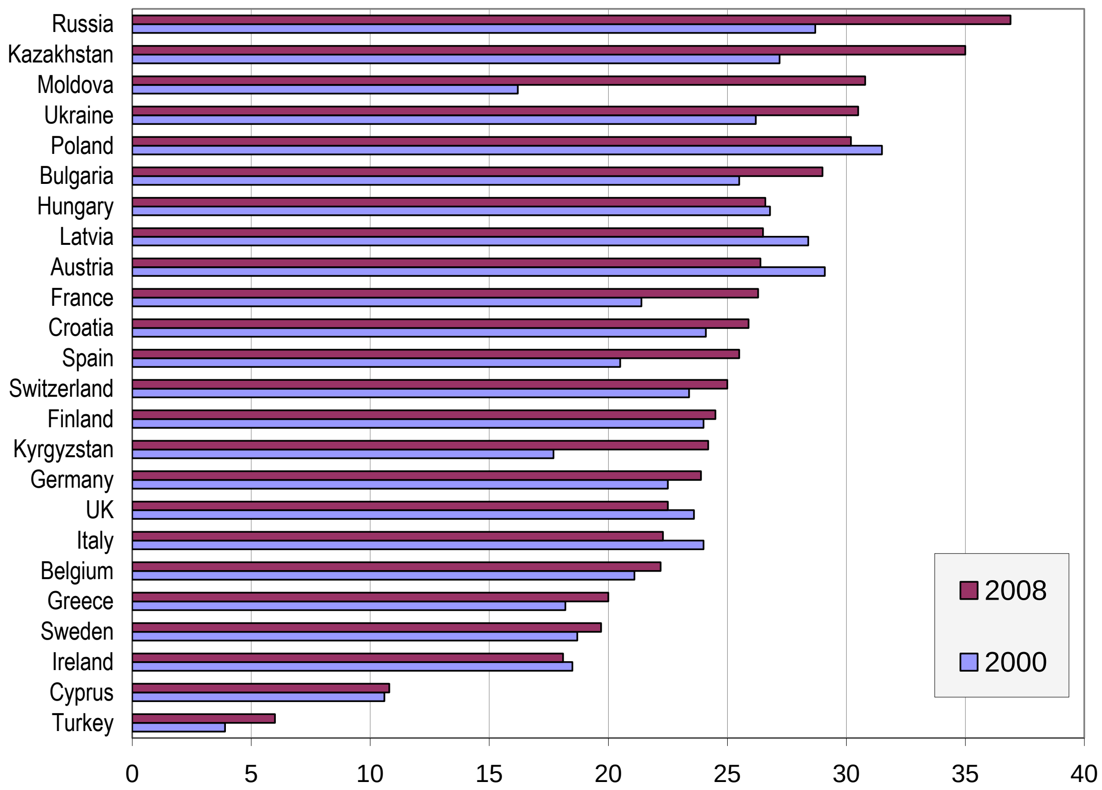
All these efforts can be coordinated internationally, but they inevitably rely on commitments made at the national level. The success of the methodological work of UNECE task forces in statistics is determined by the contributions from experts of national statistical offices and the

[11] Neyer G & Rieck D. Moving towards gender equality. Pp 139-154 in UNECE, *How generations and gender shape demographic change: towards policies based on better knowledge*, Geneva: United Nations, 2009. Available at http://ggp.unece.org

leadership they provide. The capacity building relies on the commitment of national statistical offices to learn and implement engendering their statistical systems. Similarly, the Generations and Gender Programme has been developed by expert groups based on national research institutes and statistical offices. The Generations and Gender Surveys have been conducted with national resources or have relied on national fundraising initiatives — without centralised financial support to data collection. In connection with the 150^{th} anniversary event where this paper is presented, it gives great pleasure to acknowledge the outstanding contribution of Istat and Italian academia to the work on gender statistics coordinated by UNECE as well as to the development of the Generations and Gender Programme where Italy participates.

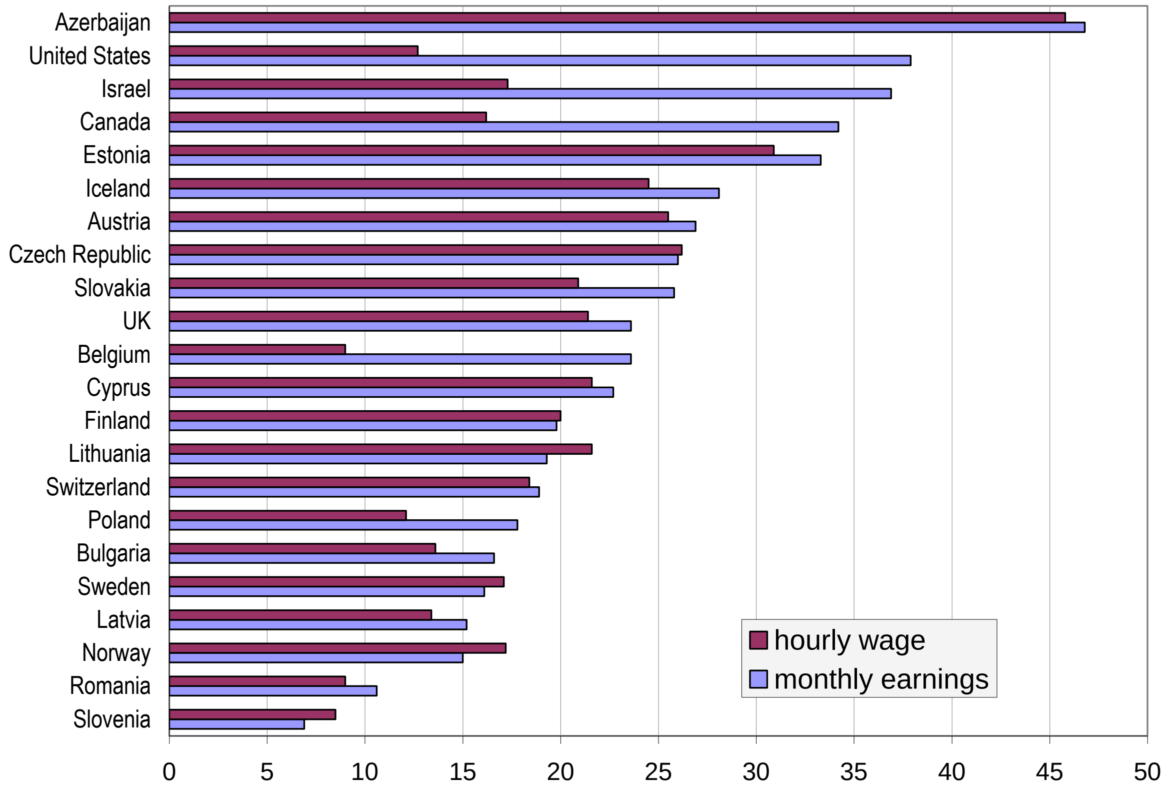
Advantages of regional and sub-regional cooperation are also related to the effectiveness of exchange of experience among manageable number of actors with a certain level of homogeneity. Such cooperation has been successful in gender statistics and research on gender issues. Its strengthening is an important factor for developing gender statistics and research in the future.

Figure 1. Percentage of women among employers in 2000 and 2008 in selected UNECE countries



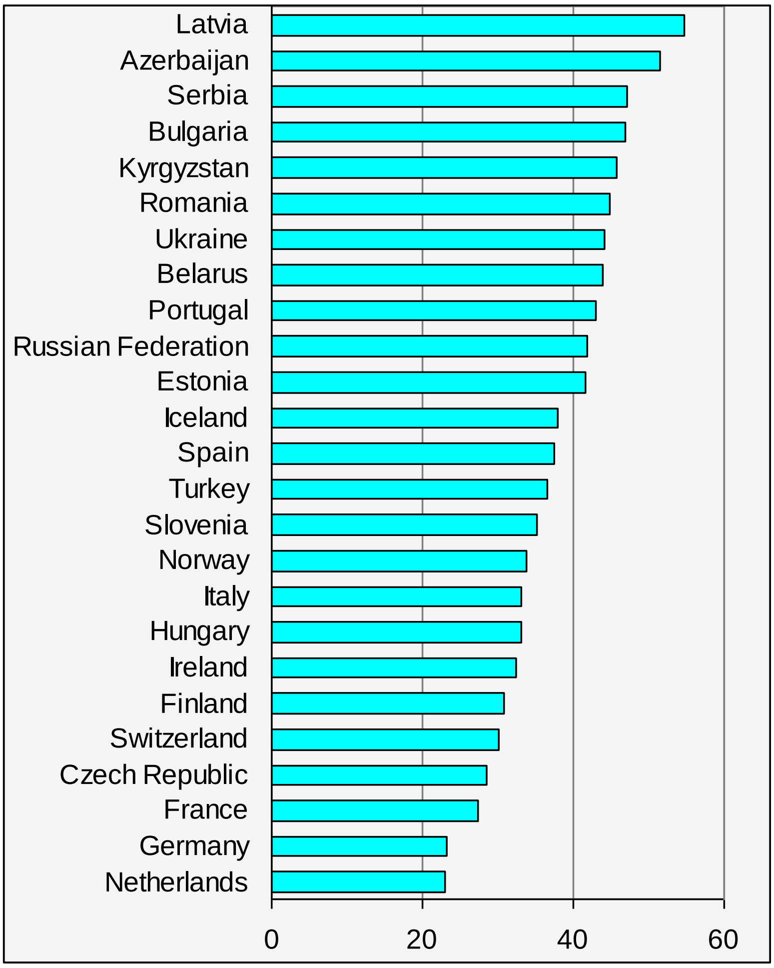
Source: UNECE Gender Statistics Database.
Notes: Employers are workers who hold self-employment jobs and have engaged, on a continuous basis, one or more persons to work for them in their business as employees. The latest values for Kyrgyzstan and Ukraine are from 2006.

Figure 2. Gender pay gap measured as monthly earnings and as hourly wage in selected UNECE countries in 2006-2008 (latest available year).



Source: UNECE Gender Statistics Database.
Notes: Gender pay gap is the difference between men's and women's average earnings from employment, shown as a percentage of men's average earnings.

Figure 3. Percentage of women among researchers in selected UNECE countries in 2008.



Source: UNECE Gender Statistics Database.
Notes: Researchers are professionals engaged in the conception or creation of new knowledge, products, processes, methods and systems and in the management of the projects. Data on Germany and the Netherlands refer to 2007 and on Ukraine to 2006.

Inferential optimality and ethics in clinical trials with covariates

Maroussa Zagoraiou and Alessandro Baldi Antognini

Abstract In biomedical and pharmaceutical trials for comparing two treatments several sequential assignment rules have been proposed to meet different demands. A well-known one is Efron's Biased Coin Design, born out of a compromise between the requirement of treatment balance, and the need for some form of randomization. In addition, in recent years several response-adaptive sequential allocation rules have been suggested with the ethical aim of skewing allocations towards the treatment that appears to be superior at each stage of the trial. In the presence of concomitant variables and treatment-covariate interactions the need for an ethical allocation could be even more stringent since the relative performance of the treatments will depend on the patient's covariates. In this paper we suggest a suitable class of compromise criteria that take into account both information gain and ethical concern, with weights depending on the treatment effects. Adopting the linear homoscedastic model with interactions between treatments and covariates, this combined criterion leads to a locally optimal target allocation that depends on the prognostic factors and also on the treatments effects and therefore it can be implemented step by step via adaptive randomization in order to converge to it.

Key words: Balance, Optimality, Compound criterion, Sequential design

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1 The Linear Model with Covariates

Let A and B be two competing treatments. We suppose that for each subject entering the trial we observe a vector Z=(T,W) of two concomitant categorical variables with levels $t_0, t_1, \ldots, t_J$ and $w_0, w_1, \ldots, w_L$, respectively. Moreover, we assume the covariates to be random, but they can be measured before assigning a treatment. Then the treatments are assigned according to a given randomization rule and a response Y is observed. Conditionally on the covariates and the treatments, patients' responses are assumed to be independent. A common model for the response is the following linear model

$$
\begin{aligned}
E(Y_i) &= \delta_i \, \mu_A + (1-\delta_i)\, \mu_B + f(z_i)^t \, (\delta_i \beta_A + (1-\delta_i)\beta_B) \\
V(Y_i) &= \sigma^2 \qquad i = 1 \geq 1,
\end{aligned}
\tag{1}
$$

where δ_i is a treatment indicator variable, with $\delta_i = 1$ or 0 if the i-th subject is assigned to treatment A or B respectively, $\mu_A,\ \mu_B$ are the treatment effects, $f(\cdot)$ is a known vector function, z_i is the vector of covariates observed on the i-th individual and β_A, β_B are vectors of possibly different regression parameters. Under this model both $(\mu_A,\ \mu_B)$ and (β_A, β_B) are of interest and the relative performance of the treatments will depend on the patient's covariates since

$$
\theta(z) = E(Y_i \mid \delta_i = 1, Z_i = z) - E(Y_i \mid \delta_i = 0, Z_i = z) = \ \mu_A - \ \mu_B + \ f(z)^t \, (\beta_A - \beta_B)\,. \tag{2}
$$

After n assignments, let $F = (f(z_i)^t)_{n\times p}$ and $\Delta = diag(\delta)$, where $\delta = (\delta_1, \ldots, \delta_n)^t$. Then $V(\widehat{\mu}_A, \widehat{\mu}_B, \widehat{\beta}_A, \widehat{\beta}_B)$= $n^{-1}\sigma^2 M^{-1}$, with M the average (*per observation*) Fisher information matrix

$$
M = \frac{1}{n} \begin{pmatrix} n_A & 0 & \delta^t F & 0 \\ 0 & n_B & 0 & (1_n - \delta)^t F \\ F^t \delta & 0 & F^t \Delta F & 0 \\ 0 & F^t (1_n - \delta) & 0 & F^t (I_n - \Delta) F \end{pmatrix},
$$

where n_A and n_B denote the number of subjects assigned to A and B, respectively, 1_n is the n-dim vector of ones and I_n is the n-dim identity matrix.

2 Optimal designs for Inference

As is well-known, for fixed sample size n, balancing the covariates is a desirable property for inference and now we provide a brief explanation for this (for a detailed discussion see [3]). We define a *balanced design* as an allocation vector δ with both the following properties: (B1) $\delta^t \delta = (1_n - \delta)^t (1_n - \delta)$ and (B2) $\delta^t F = (1_n - \delta)^t F = 2^{-1} 1_n^t F$. Condition (B1) means that the two treatments are globally equireplicated. If the model is without interactions among covariates, (B2) states that A and B are equally replicated at every level of each blocking factor (marginal balance), while in the presence of interactions among covariates (B2) means that A and B are equally replicated also within every row-column intersection (the so-called joint balance), which implies marginal balance. For given covariates, an allocation satisfying (B1) and (B2) is optimal for model (1) wrt any information criterion Φ^I of the matrix M, which is convex and invariant under the switching of A and B. These criteria represent a measure of loss of inferential precision and should be minimized. For instance, assuming the well-known $D-$optimality, $\Phi_D^I(M) = \det\left(n^{-1}M^{-1}\right)$, when the model is full (i.e. $f(z) = (t, w, tw)^t$) we obtain

$$\det\left(n^{-1}M^{-1}\right) = 1/\prod_{j=0}^{J}\prod_{l=0}^{L}\pi(t_j,w_l)(1-\pi(t_j,w_l))N^2(t_j,w_l), \tag{3}$$

where $N(t_j,w_l)$ is the number of subjects within the stratum (t_j,w_l) after n assignments and $\pi(t_j,w_l) = \sum_{i=1}^{n}\delta_i \mathbb{1}_{\{Z_i=(t_j,w_l)\}}/N(t_j,w_l)$ is the proportion of allocations to A within the pattern identified by the pair (t_j,w_l). Since $\Phi^I(M) = \Phi^I(\pi;N)$, with $\pi = (\pi(t_0,w_0),\ldots,\pi(t_J,w_L))$ and $N = (N(t_0,w_0),\ldots,N(t_J,w_L))$, is a r.v. depending on the random nature of the covariates, from now on we take into account $\widetilde{\Phi}^I(\pi) = E_{\mathbf{Z}}(\Phi^I(M))$.

3 Optimal designs for ethics

From an ethical viewpoint, a natural demand consists in maximizing for any given sample size the percentage of subjects who receive the best treatment. Assuming model (1), the expected proportion of successes is

$$\sum_{j=0}^{J}\sum_{l=0}^{L} p_{jl}\left\{\frac{1}{2}-\left(\frac{1}{2}-\pi(t_j,w_l)\right)sgn(\theta(t_j,w_l))\right\},$$

where $sgn(x)$ represents the sign of x and $p_{jl} = \Pr\{Z_i = (t_j,w_l)\}$. However, from (2) the superiority/inferiority of A or B and the relative performance of the treatments depend on the subject's covariates. Thus, it seems reasonable to adopt as ethical criterion the following expression

$$\widetilde{\Phi}^E(\pi) = \sum_{j=0}^{J}\sum_{l=0}^{L}|\theta(t_j,w_l)|p_{jl}\left\{\frac{1}{2}-\left(\frac{1}{2}-\pi(t_j,w_l)\right)sgn(\theta(t_j,w_l))\right\}. \tag{4}$$

Obviously, the ethical criterion (4) depends on both the covariate profiles and the unknown parameters of the model and the optimal ethical target is the one that assigns all the patients to the better treatment, i.e. $\pi_E^*(t_j,w_l) = \mathbb{1}_{\{\theta(t_j,w_l)>0\}} \quad \forall(j,l)$.

4 The compromise criterion

Given criteria $\widetilde{\Phi}^E$ and $\widetilde{\Phi}^I$, a very simple and natural way to define a "compromise" criterion consists in taking a suitable weighted average of them. However, they are not homogeneous measures and need to be standardized to a comparable scale. Thus, from now on we suggest a compromise based on a combination of the standardized ethical criterion, i.e. $\Psi^E(\pi) = \widetilde{\Phi}^E(\pi)/\widetilde{\Phi}^E(\pi_E^*)$, and the standardized version Ψ^I of the inferential criterion, namely $\Psi^I(\pi) = \widetilde{\Phi}^I(\pi_I^*)/\widetilde{\Phi}^I(\pi)$, where π_E^* is the optimal ethical target and π_I^* represents the optimal inferential target minimizing

$\widetilde{\Phi}^I(\pi)$. Clearly, Ψ^E and Ψ^I should be maximized. By introducing an ethical weight ω which is assumed to be a continuous and increasing function of $E_Z(|\theta(z)|)$ such that $\omega : \mathbb{R}^+ \to [0;1)$ with $\omega(0) \to 0$, we let as a compromise criterion

$$\Psi_\omega(\pi) = \omega\left[1/\Psi^E(\pi)\right] + (1-\omega)\left[1/\Psi^I(\pi)\right]. \tag{5}$$

The compound criterion is a convex function of π [1] and it can be seen as the reciprocal of the weighted harmonic mean of Ψ^E and Ψ^I. Therefore, the problem consists in finding the design that minimizes this compromise criterion which depends on the prognostic factors, the treatments effects and also on the choice of the ethical weight ω. When the inferential criterion is strictly convex, (5) leads to a unique locally optimal target allocation, π^*, which satisfies $\left.\frac{\partial \Psi_\omega(\pi)}{\partial \pi}\right|_{\pi^*} = 0$. Thus, several adaptive randomized allocation rules can be implemented step by step in order to converge to it, such as the family of covariate-adjusted response adaptive designs in [2]. A thorough discussion of the properties of the compound criterion (5) for binary responses can be found in [1]. As an example, adopting $\omega(x) = \left(1+x^{-2}\right)^{-2}[2-\left(1+x^{-2}\right)^{-2}]$, under the full model and in the case of two binary covariates, the standardized $D-$optimality is $\Psi_D^I(\pi) = 2^8\prod_{jl=0}^1 \pi(t_j,w_l)(1-\pi(t_j,w_l))$ since the optimal inferential target is $\pi_I^*(t_j,w_l) = 1/2 \quad \forall (j,l)$. The following table shows the obtained compound optimal allocations $\pi^*(t_j,w_l)$:

Table 1 Compound optimal targets when the $D-$optimality is adopted.

	$p_{00}=0.2$, $p_{10}=0.3$, $p_{01}=0.4$, $p_{11}=0.1$				$p_{00}=p_{01}=p_{10}=p_{11}=0.25$			
	$\pi^*(0,0)$	$\pi^*(1,0)$	$\pi^*(0,1)$	$\pi^*(1,1)$	$\pi^*(0,0)$	$\pi^*(1,0)$	$\pi^*(0,1)$	$\pi^*(1,1)$
$\mu_A-\mu_B=1$ $\beta_{A_1}-\beta_{B_1}=1$ $\beta_{A_2}-\beta_{B_2}=1$ $\beta_{A_3}-\beta_{B_3}=1$	0.5852	0.7147	0.7577	0.6580	0.6091	0.6946	0.6945	0.7968
$\mu_A-\mu_B=-0.5$ $\beta_{A_1}-\beta_{B_1}=1$ $\beta_{A_2}-\beta_{B_2}=2$ $\beta_{A_3}-\beta_{B_3}=-2$	0.4788	0.5317	0.6199	0.5106	0.4780	0.5220	0.5650	0.5220

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[1] Note that the suggested criterion (5) is a convex function of π since it is a linear combination of the reciprocals of Ψ^I and Ψ^E which are both convex. Indeed, $\widetilde{\Phi}^E(\pi)$ in (4) is linear and thus concave, and also non-negative. Therefore its reciprocal is convex in π.

Statistical Quality Control: the role of the Italian Statistical Society

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Abstract This paper briefly discusses the evolution of the concept of *Quality*, which is largely linked to an assessment of the characteristics of the products in order to verify compliance with product specifications. The Italian Statistical Society (SIS) has been active in SQC with the Working Group on *Statistics for Technology and Industry* (1990-2002) and with the Coordination Group on *Statistics for Enterprise* (2003-2008). The main aim of the paper is to offer an outline of the contributions of Italian Statisticians in the framework of the statistical methods for Quality from the nineties onward with reference to the Proceedings of the SIS Meetings and to the above Groups.

1. Quality: historical background and importance

Quality is not a new concept in modern industry and business, contrary to common belief; it is at least as old as industry itself (in 1887 W.C. Procter, the grandson of the founder of Procter&Gamble, stated that critical issues to managers of manufacturing and service organizations are: productivity, cost and *quality*). The Statistical Quality Control (SQC) was a new concept in the seventeenth-eighteenth centuries but its major development and spread has occurred in the last 90 years. It is officially recognized that W.A. Shewhart of the Bell Telephone Laboratories is the pioneer in applying statistical methodologies and thus in giving rise to SQC; he proposed the extensive use of Control Charts for identifying quality problems in production processes and ensuring consistency of output with specifications. At that time, in the Bell Company there was a

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group very active in developing the use of Statistics in the Statistical Process Control (SPS). Two members of this group were H.F. Dodge and H.G. Romig: they pioneered the statistical theory of sampling inspection (Dodge-Romig *Sampling Inspection Tables*). The group also included G.D. Edwards (director of the *Quality Assurance* in Bell System) and W.E. Deming (the most influential man in the quality revolution). After control charts and sampling plans, other statistical methods, such as correlation analysis, analysis of variance and design of experiments, found their way into the laboratories and research departments. During the World War II the U.S. military introduced the use of sampling procedures and imposed stringent standards on suppliers (the sampling tables MIL-STD are evidence of this). After the war (late 1940s and early 1950s), the Japanese welcomed the presence of American consultants, with outstanding personalities as W.E. Deming and J. Juran, and, rather than concentrating on inspection, they focused their effort on improving all organizational processes through the people (the *management*): Japanese Company Wide Quality Control (CWQC) model. CWQC is a set of systematic activities carried out by the entire organization to provide products and services with a high level of quality that satisfies customers at the appropriate time and price. The *Total Management of Quality* (TQM) is the western development of the Japanese model: it may be defined as the management of initiatives and procedures that aim to achieve the delivery of high quality products and services. Its premise is that the quality of the products and processes is the responsibility of "everyone". Hence, TQM involves management, workforce, suppliers, and even customers, in order to meet or exceed customer expectations. In the last few years new quality systems have moved from manufacturing to services: healthcare, education, transport and government sectors. It is evident that the economies of the most developed countries are becoming more service oriented and *Customer Satisfaction* is the driving force in the success of a company. Most of the statistical methods for quality thought up for quantitative variables should now be reconsidered for categorical variables too. Unfortunately, neither business professionals nor academics agree on a universal definition of *Quality*; nevertheless, we mention two definitions: *Quality is defined as fitness for use* (D.C. Montgomery, Statistical Quality Control, 1985); *Quality is the goodness or excellence of some thing. It is assessed against accepted standards of merit for such things and against the interests/needs of users and other stakeholders* (G.F. Smith, 4, TQM, 1993).

2. A brief presentation of bibliography headings

The bibliography for this paper makes reference to a group of more than 120 papers, most of them from dedicated issues of *Statistica Applicata* (1991, 4; 1995, 2; 1997, 1; 1999, 3; 2004, 4; 2006, 2). Many of the authors were members of the two SIS – Groups *Statistics for Tecnology and Production*, coordinator Angelo Zanella, and *Statistics for Enterprise*, coordinator Mario Montinaro.

Scales and measurements. These are, of course, a preliminary essential topic. In [2], Bertrand Russel stated: "The measurement of characteristics, in the most general sense, is any method by which a corresponding homomorphic -that is univocal and reciprocal-function exists between the characteristics of a given kind and some or all numbers". The assignment of a number to any characteristic of an experimental unit is here regarded in an axiomatic way. When we are dealing with an *extensive* quantity, for which a specific realization can be assumed to be a unit, we may use the ratio scale, defined except for the scale unit, or interval scale with an arbitrary origin, for which the admissible transformations are affine linear. When considering characteristics whose modalities can only be ordered, ordinal scales can be employed, which are defined except for strictly monotonic functions. Three main sources of error may be encountered: a) inadequacy of the interpretative model; b) a zero mean random error due to the measurement procedure. This ideally arises when independent test results are obtained under the same experimental conditions. This is referred to as the *repeatability* error variance σ_r^2; c) a further zero mean random error of variance σ_R^2 due to different equipments and operators. The last two errors lead to a *reproducibility* variance $\sigma_r^2 + \sigma_R^2 + 2\mathrm{cov}[\varepsilon_r, \varepsilon_R]$, with obvious notations. Items [1] and [3] deal with the framework of this subsection.

Acceptance sampling plans. Items [4] and [5] outline the attempt to improve the current use of attribute sampling plans. These are typically carried out according to the well-known standards MIL STD 105D. Two basic indicators included in these standards are the Acceptable Quality Level (AQL), which expresses the maximum fraction of nonconforming units still acceptable to the customers, and the Average Outgoing Quality (AOQ), i.e. expected average quality of outgoing product for a given value of incoming product quality. In [5], by adopting an empirical Bayesian point of view, AQL is regarded as varying at random from lot to lot according to a Beta distribution. The authors consider two posterior measures of performance, concerning the residual portion of defective elements of a lot, conditionally to the number of defective units observed in a sample. Paper [4] employed a similar methodology for dealing with AOQ. A random sample is taken from each lot over time and the number of observed nonconforming elements is assumed to follow a Poisson distribution.

Process control. Some of the papers are related to deepening and improving the methodology of Control Charts. The main aim of [8] is the comparison between a single variable control chart for means and a control chart with two other added *warning* limits. In [11] the multivariate case is considered. A predictive approach based on the optimum predictor of the controlled characteristic vector assumes that the true underlying stochastic process is an Integrated Moving Average vector process of order 1. In [10], the authors present a survey of control charts, with discussion. In [9], the Process Capability concept is extended to the multivariate response case. The last two papers we mention, [6] and [7], are related to Stochastic Process Control (SPC). Models and techniques of the time series analysis are extended to SPC and implemented through automatic devices.

Taguchi approach. There are two basic principles: a) products and manufacturing processes are affected both by factors controllable by the designers and by *noise* experimental factors. The latter expresses the random variable environmental conditions, raw material properties, the customers' use modalities, etc.; b) the variability, expressed in term of variance, of a product quality characteristic (*response*) depends not only on the noise factors, but also on the controllable factors, [13]. The Taguchi methods typically rely on statistical experimental designs: [12] presents a real example of Taguchi's optimization methods for a wine-making process.

Design of experiments for process improvement In [14], the Author presents the innovative approach of entirely or partially replacing the physical experiment with a numerical one. A legitimate rationale for a single or combined approach is that the physical experimentation may be nearly impossible or exceedingly expensive; therefore, the use of the codes in the product/process development phase have become straightforward and quite inexpensive. The main idea among the users of numerical

experiments is to seek an appropriate model, hopefully close enough to the real one, but lending itself more easily to numerical evaluation (*metamodel*). The intrinsic difference between physical and numerical experiments is the apparent lack of randomness of the latter; recent research also aims to reduce the weight of this discrepancy and a classical statistical approach may be adopted with numerical experiments too, including concepts such as experimental error, precision and reliability of estimates.
Environmental Survey - Subjective evaluations and customer satisfaction . Most of the examined literature is devoted to the manufacturing field. However, more recent research has begun to focus on quality in broader sense: [16] underlines the relationship between quality control and environmental protection, a promising new research context. The statistical methodologies of SQC for product/ processes can't be directly transferred into the service sector, where most of the variables are categorical and statisticians are aware of the difficulties of modeling: in [17] there is a latent variables structural model for ISO 9000:2000 and [15] is strictly linked to the introduction.

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