Fifty Years of Business Confidence Surveys on Manufacturing Sector

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Abstract In this work the evolution of the Italian 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, Sampling Design, Administrative Archives, Confidence Indicators, Leading Indicators, Cyclical Analysis, Simulation.

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. About sixty years ago an innovative project was started by the European Commission with the purpose of monitoring the confidence of the economic agents collected in a simple and effective way, i.e. through qualitative opinion surveys

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performed with monthly frequency. The project gradually involved all the European countries as to currently comprise all the 27 member states.

With this regard, the European Commission states that "the principle of harmonisation underlying the project aims to produce a set of comparable data for all European countries" (EC, 2006). To achieve this goal institutes must respect two basic principles: (i) to use the same harmonised questionnaire; (ii) to strictly respect the Commission timetable in carrying on the survey and transmitting the results. On the other hand, statistical institutes are left relatively free to define the other aspects of the entire process from data collection to sample design (apart from a required minimum sample size) and processing techniques. They are also invited to conform to 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 economic and business trends and expectations for the near future. Information collected is qualitative, mainly on a three-option ordinal scale, whose values (for example, "above normal"," normal", "below normal"; "high", "normal", "low", etc.) may be sorted into a sequence without any ambiguity. Moreover, possible answers are always presented along 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; number of months of production assured; etc.).

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.

In Italy, this survey has a very long history, and has always been embedded in the European Project. ISCO[2] (merged in 1999 in ISAE[3] and in 2011 in ISTAT[4]) was among the three statistical institutes (with IFO for Germany and INSEE for France) which started the 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 et al., 2005), whereas the weighting system was based on internal and external weights at stratum level according to the OECD guidelines (OECD, 2003). Following the European Commission recommendations, in May 2010 data were re-classified according to Nace Rev.2 classification.

[2] Institute for Short Term Analysis
[3] Institute for Economic Analyses
[4] Italian National Institute of Statistics

2 Sampling design

At the beginning, the survey was intended as a purposive panel of *leading firms*. According to 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. The original sample size was about 2,600 units stratified by a very detailed economic sectors breakdown (i.e. mainly reflecting the NACE 1 three digits classification). This purposive sample structure has been preserved over about 25 years. Since the eighties of the last century, the increasing use of computational methods led in 1986 to a first thoroughly re-designing of the sample by adopting a proportional allocation, which allowed for an estimation of overall regional outcomes (Pinca, 1990). The double need to obtain estimates both with sectorial and regional breakdown was dictated by the European project guidelines to collect both country and sectorial data, and by the increasing domestic demand for local information. Both these needs, however, were conflicting with the precision of the domain estimates as the sample size could not be increased due to budget constraints,

As an alternative solution, at least to improve the quality of the overall estimates, further sample designs were tested. In 1998, a univariate *x*-optimal allocation (Martelli, 1998) was applied to a stratified sampling design with 22 macro sectors (according to Neyman-based workforce variance, estimated from previous waves of the survey), 3 firm sizes and 19 Nuts areas (i.e. mainly Nuts-2). This allocation allowed for the calculation of a sampling error of only about ±0.5% according to the average of the three qualitative questions composing the confidence indicator.

From 1999 onwards, the availability of the business frame ASIA[5] (Statistical Archive of Active Firms) provided by ISTAT (Eurostat, 2006; ISTAT, 2010) resulted in a significant improvement of several aspects of the survey design, namely: (i) in defining the frame, (ii) in unit selection, (iii) in variance calculation for the Neyman x-optimal allocation[6], (iv) in the sectorial classification, (v) in simulation exercises for testing and validating the sampling design (Chiodini et al., 2010a; 2010b; 2011a; 2011b).

[5] The ASIA archive is set up and yearly updated by the Italian National Institute of Statistics by merging some main administrative archives that is those of the Italian Economy Ministry, Italian Chamber of Commerce, Italian Social Security (INPS), Italian National Insurance Institute for Industrial Accidents (INAIL), Italian Telephone Company (Telecom) and Italian National Electricity Board (ENEL). ASIA represents the most complete and updated source of the Italian firms' universe. It allows reliable and complete information for both building the sample and selecting the addresses, overcoming the usual problem to have a partial frame list in comparison to the universe. It is disseminated with about one-and-a-half year delay with respect to the information collected. This fact further allows keeping updated information on the universe between the Census Surveys, which are usually carried out every 10 years.

[6] The 1998 sample allocation benefited from the 1996 pilot release of the ASIA archive.

According to (i) above, by using the business frame Asia, under and over coverage problems are now almost completely solved. However, a remarkable time lag persists: ASIA is disseminated about one year and six months later with respect to the information collected.

According to (ii) above, the nearly complete information offered by ASIA is an optimal pre-condition for selecting units for the original sample, which usually relies on administrative settings (classifications of economic activities, areas, etc.) and it is likely affected by between-strata heterogeneity (in terms of population size and stratum variance).

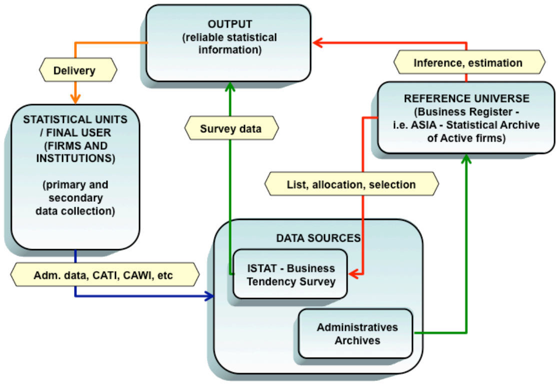
According to (iii), above, the availability of the business frame ASIA allows for the application of the Neyman allocation to strata using the real variances (on workforce), and not estimated variances drawn for the survey itself (as it was customary in previous attempts).

According to (iv) above, on March 2009 the European Commission set the deadline to have all the BCS classified according to the Nace Rev.2 classification. This requirement implied, among others, the revision of the domains (strata) of the survey (Eurostat, 2006). To this purpose, the ASIA archive played a determinant role by offering in 2007 the double classification of the firms according both to the old Nace rev.1 (Ateco 2002) and to Nace Rev.2 (Ateco, 2007) allowing both for the careful reconstruction of the time series of the results and the revision of the strata.

According to (v) above, only recently researchers have dealt with computational methods and simulations in the field of sample allocation (Chiodini et al., 2010b) as it represents a powerful tool for testing the sample allocation efficiency at a stratum level. This occurrence is useful in the allocation exercise when a high number of strata is required. Furthermore, simulation has an additional important feature: as confidence surveys do not have a benchmark in the universe to validate the outcomes, the only possible strategy to evaluate the power of the estimates is offered by simulation tools. It must be noted that in recent literature on this topic there are plenty of proposals for new estimators which are related to the introduction of new methods of sampling unit allocation within population strata, representing a valuable alternative to Neyman's optimal allocation method (see for example, Étoré and Jourdain B., 2010; Kaur et al., 1997), and whose statistical features are validated through intensive Monte Carlo simulation.

In Fig 2.1 the Confidence survey is synthetically presented by showing all the components of the entire process and their reciprocal relationships.

Figure 2.1: Current Confidence Survey design process: actors and actions



Source: Slide presented at Enhancement and Social Responsibility of Official Statistics, 1th SIS-vsp Workshop, Rome, April 27-28. See Chiodini et al. 2011b.

The availability of the ASIA archive allowed for the setting of new computer-driven strategies for simulation (when methods and estimate performances have to be simultaneously compared). For example, Chiodini et al. (2010b, 2011a) used a method called *Sequential Selection-Allocation*, which is a sequential process to empirically evaluate the performance of the various sampling allocation methods by constructing a new labeled list with population units re-labeled within the stratum according to their selection order, after performing a Sampling Without Replacement (SWOR) of size equal to the stratum size. This process is repeated *n* times. From this new labeled population, all the allocation algorithms can be performed and their efficiency evaluated at the same time. 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. In a recent work, Chiodini et al. (2010a) compared several allocation methods for the BTS survey (such as the Neyman allocation - currently applied on areas, the Bethel multivariate allocation - as widely applied by ISTAT, now available as a "generalized software", the uniform and the proportional allocations, and a novel method, namely the Robust Optimal Allocation with Uniform Threshold method – ROAUST9, which is a Neyman domain method) by applying the SSA simulation technique, in order to re-think the allocation method to be used in a near future.

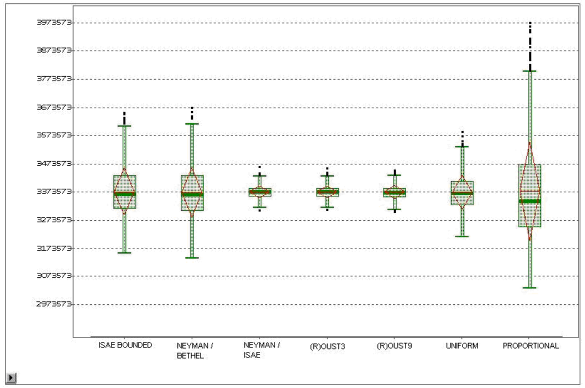
Chiodini et al. (2010a) use the statistics on the overall workforce in order to compare the allocation methods, as in their simulation the workforce can be considered a proxy of the data to be collected (investigated). Useful criteria are the Absolute Total Error (|TE|) and the Relative Absolute Total Error (|RTE|), given by:

$|TE| = |Bias| + \sigma_r$

$|RTE|$: Relative $|TE| = |Bias / \mu_r| + \sigma_r/\mu_r = |Bias / \mu_r| + CV_r$

where Bias is equal to $\mu - \mu_r$ (μ is the population mean and μ_r the replication mean) and σ_r is the standard error (SE) of the replicates.

Figure. 2.2: Total Error of the distribution replicates



Source: Chiodini et al. 2010a

Both Bias[7] - that refers to systematic errors - and SE – that refers to the precision of the estimators - are lower in the Neyman allocation when applied to the overall population Fig.2.2). While the distribution of replications of all the methods based on Neyman's method appear to be centered on the frame mean (i.e. unbiased), the uniform allocation and, at larger extent, the proportional allocation result skewed. Furthermore these two latter methods show a remarkable higher volatility[8]. On the other hand, the ROAUST9 method (alt-

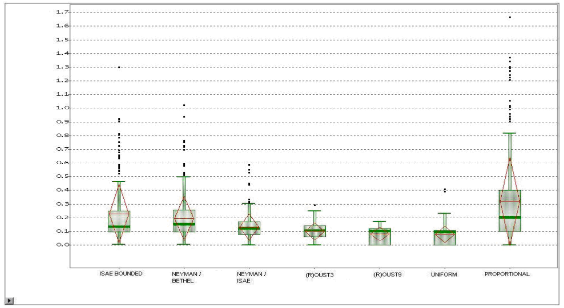
[7] It must be noted that in this work our main focus is not on asymptotic properties of the allocation methods. Therefore, given a finite number of replications, high bias levels will denote the unsuitability of the methods conditioning on the choice of the stratification variables and the unit selection mode.

[8] Better bias and precision levels for the uniform allocation compared to the proportional allocation are connected to an inversely proportional relation between the number of the units within the strata and variability (which is typical of the sectorial and size stratification in business surveys).

hough with a little loss in terms of Bias and precision), results to have the higher accuracy within the strata (Chiodini et al., 2010a).

Looking backwards to the first years in which the survey has been carried out, if it is possible from a statistical point of view to accept the purposive sampling selection then performed as a quantitative comparison of quality indicators is out of our reach. A possible validation can in this case arise only *ex-post* from a cyclical analysis, as it will be shown in the next section.

Figure. 2.3: Relative Total Error by stratum



Source: Chiodini et al. 2010a

3 Cyclical analysis as a validation tool

The results from the business survey data need to be validated in order to assess their usefulness as well as their relation with some quantitative indicators. In particular, in this case the industrial production index is a natural candidate for such a comparison. Here we simply consider the comparison between the industrial production index and the confidence indicator, even though a more detailed analysis could in principle be carried out also considering the single variables composing the confidence.

A direct comparison of confidence and industrial production, however, would not lead to any meaningful result. In fact, we have to consider that these indicators, while both referring broadly to the activity in the manufacturing sector, nevertheless feature also some subtle differences which must be taken into account while building a possible relation. With respect to this point it is useful to consider the industrial production index as a sum of components: a long term trend, which can be represented by a low order time polynomial; a seasonal, that is the regular movements with period up to a year; the cycle, a recurrent oscillation along the trend with a variable amplitude and periodicity between, approximately,

two and ten years; the irregular, i.e. a very short term source of variation not falling in the previous cases.

Considering the confidence indicator, its composing variables are a kind of *diffusion indexes*, defined as the excess of the percentage of firms declaring to face 'above the trend' production or order books minus those facing a 'below the trend' value (the reverse applies to stocks of finished goods). Therefore, the confidence indicator can also be seen as a diffusion index, capturing what can be thought of as a common component in manufacturing firms' production. This common component is not related to seasonality or long term trends, which are excluded by the definition of the survey question; it is rather likely to represent the cyclical component.

Therefore, the relation between the confidence indicator and the industrial production index will be analysed on the ground of the cyclical behaviour of both series. In order to accomplish this task we will consider various transformations of the industrial production index. A required preliminary step consists in removing its strong seasonal variation, obtaining the so called 'seasonal adjusted' series, which here is obtained by means of an unobserved component model (Harvey, 1990).

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. While the first is consistent with the original definition of business cycle given in Burns and Mitchell (1946) defining a recession as a decline in the *absolute* level of a series, the second and the third are more in line with Mintz (1969) and define a recession, as a decline in the *de-trended* series or, respectively, in the *growth rate* series.

In all the cases the routine proposed by Bry and Boschan (1971) is used to identify the turning points and, therefore, expansion and recession phases. When the classical cycle is considered, business cycle phases are identified directly on the seasonally adjusted industrial production index. In the case of the deviation cycle, it is necessary to specify a suitable de-trending procedure. Due to the fact that turning points detection is highly sensitive to the de-trending method used (Canova 1999) here we rely on two different methods, using the cycles extracted, respectively, with a Butterworth filter (Pollock, 2000) and the Hodrick-Prescott filter (Hodrick and Prescott, 1997). These are both low-pass filters for trend estimation, in a series composed by a trend and a cycle component. The filter estimates the trend, while the residual, which is therefore taken to represent the cycle, is considered in the subsequent analysis. Finally, the growth cycle series considered is the seasonal difference of logs of industrial production.

Once the turning point detection procedure is applied, 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 3.1: Correlation between business cycle phases with respect to that of the confidence indicator

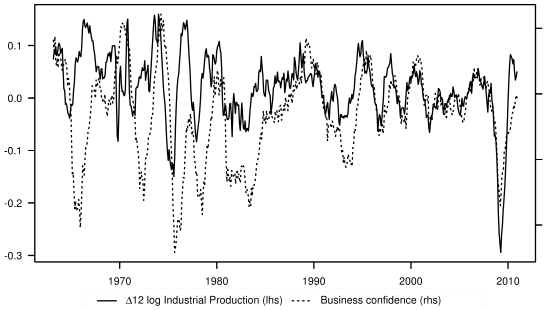
	Level	Butter-worth	Hodrick-Prescott	Seasonal Δ of logs
Correlation at 0	0.210	0.338	0.286	0.487
Max correlation (lag)	0.353 (8)	0.417 (5)	0.321 (2)	0.487 (0)
	Classical	Cycle	Deviation Cycle	Growth rate Cycle

Source: Estimations on ISTAT and ISCO-ISAE data

Table 3.1 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 can be summarized as follows: (i) correlation increases, passing from the classical cycle to the growth cycle, with the deviation cycle somewhat in the middle; this result therefore supports the usual procedure of practitioners of building a relation between seasonal difference of logs of industrial production and confidence indicator for forecasting purposes, given the earlier availability of the latter; (ii) 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.

The results clearly point out that the concept of growth rate cycle of industrial production is closer to that implied by the confidence indicator.

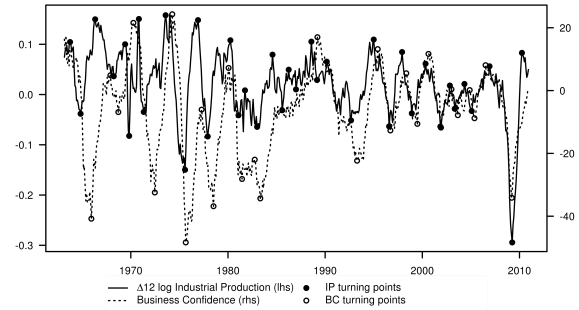
Figure 3.1: Confidence and Business Cycle



Source: Estimations on ISTAT and ISCO-ISAE data

Confidence (Fig. 3.1) faithfully tracks the evolution of the Italian economy business cycle turning points, as recorded by the industrial production index, during the whole period considered, even though the amplitude of business cycle phases does not appear to be always consistent among the two indicators. In the first two decades the shifts of the IP are less precisely recorded by the confidence indicator potentially suggesting the rougher nature of the first sample designs. Starting from the nineties, however, a more marked similarity between the profiles of the two series appears evident. Estimated turning points from the two series are shown in Figure 3.2.

Figure 3.2: Estimated turning points



Source: Estimations on ISTAT and ISCO-ISAE data

4 Concluding remarks

In this paper we presented the Business Confidence Survey for the Italian Manufacturing sector that was conducted since the sixties of the last century. We synthetically discussed the statistical features of the survey and the improvements occurred over the years. The Confidence indicator is then described and compared to different kinds of economic cycle as recorded by the industrial production index. The paper shows that Confidence faithfully tracks the economic business cycle mainly since the nineties.

From a statistical point of view these occurrences could also support the hypothesis of the effectiveness of the improved sample allocation applied since the nineties (ISAE-Neyman) and give support for the future to the selection of the ROAUST one as suggested by the simulation exercise.

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