

# Internationalisation and the Agglomeration Effect: Evidence from the Italian Automotive Supply Chain

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## Abstract

We study the internationalisation process in a representative sample of 786 firms in the Italian automotive supply chain. Most of these firms have agglomerated in the Turin industrial district, the cradle of FIAT, the dominant Italian car-maker and one of the global player in the automotive industry. Both FIAT and its suppliers have experienced a substantial process of internationalisation. Our main research question is straightforward: is the internationalisation process of the Italian firms in the automotive supply chain driven by the off-shoring of FIAT activities, or is it a relatively independent process, driven by the cumulated effect of agglomeration in a Marshallian-type urban district? We build an Internationalisation Strategy Index, that discriminates between firms that do not export at all, or that export without owning structured sale or production organisations abroad, or that possess such organisations. After controlling for firms' characteristics, and building three simple agglomeration indicators, we perform a multinomial logit micro-econometric analysis. We find that there is an agglomeration impact on firms' internationalisation, independent from the vertical linkages between suppliers and their main customer FIAT. In fact, dependency from sales to FIAT decreases the probability of internationalisation, while being located in a high-density industrial district has the opposite effect. This result points to a positive impact of agglomeration per se, particularly in a urban context, and rejects the alternative view that internationalisation of firms in the supply chain is driven by the core firm in the "hub-and-spoke" district.

**Key words:** Internationalisation, Automotive Industry, Agglomeration Effect, Spatial Distribution of Regional Economic Activity

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# 1. Introduction

Agglomeration of small and medium sized enterprises (SMEs) around a large firm departs from the traditional Marshallian district in several ways. This environment, sometimes labelled as the 'Hub-and-Spoke' pattern (Markusen 1996), differs from the flexibly specialised district, as SMEs cluster around one or a small number of core large firms. According to Gray *et al.* (1996), who describe the Seattle region, the proximity between a large firm and its suppliers may generate sustained growth, as the local enterprises benefit from the greater investment, technology spillovers and market opportunities of the dominant firm. In this vein, Florio (1996), Giunta (2000), Bellandi (2001), Romero and Santos (2007) discuss examples of the pattern of polarised clusters. Kim and Zhang (2008), combining the 'Hub-and-spoke' pattern with a strategic management model develop a theoretical framework to investigate the inter-firm network between the foreign-invested enterprises and local firms. Studying the electronic industry in Qingdao, China, they conclude that geographical concentration of foreign-invested enterprises can contribute to local industry cluster and to local development. In an earlier contribution Scott (1992), looking to hi-tech industrial districts in Southern California argued that large production units sustain the growth of local SMEs through the "intertwined notions of the social division of labour, external economies and local agglomeration". He concluded that "neither large establishments nor the internationalization of the economy necessarily threaten the continued viability of industrial districts". This optimistic view is not entirely shared by other empirical research that points to the risk of regional vulnerability if the large dominant firm in a geographical cluster experiences severe cyclical downturns, or strong international competition, or if it relocates..

The internationalisation dimension of the "Hub-and-Spoke" district has been explored by recent empirical literature (e.g. Frigant, 2002 and 2007), particularly focussing on technological regimes, change in the concept of proximity and scope of competition (Guerrieri and Petrobelli, 2004 and 2006). For a review of several related issues see for example Dunning (2004) and other papers in Cantwell (2004). While the core firm is often a global player, with wide access to international markets and sustained foreign direct investment, its local suppliers are usually much more constrained by their human capital, access to finance, and lack of

proprietary knowledge. Thus, in some circumstances, they are unable to adapt to the internationalisation process of the core firm. Then, the off-shoring of activities of the dominant firm may hinder the growth of its local suppliers, since it may cause the loss of local skills and technological spillovers, thereby leading to the decline of the industrial district. There are, however, two possible countervailing mechanisms: (a) the core firm may involve the local suppliers in its own off-shoring activities, either by inducing the suppliers to export to its subsidiaries abroad, or event to re-locate their plants; (b) alternatively, faced by a decrease in their traditional sales to their core customer, the local SMEs can be forced to look for new market outlets, including abroad. In this second perspective, the linkages with the core firm becomes less important, and the suppliers may take advantage of their agglomeration, going back to a more Marshallian-type growth pattern. We are interested in these response mechanisms, and our case-study represents an important example of the second one, that is internationalisation primarily enhanced by agglomeration economies.

The automotive supply chain constitutes a privileged point for empirical analysis of internationalisation of SMEs in a 'hub-and-spoke' environment. The industry felt the full force of the globalisation of the market for intermediate and finished goods, a process that was effectively summarised by the expression "the world that changed the machine" (Boyer and Freyssenet, 2001)<sup>1</sup>. Over the course of 15 years, there was an acceleration in changes occurring in relation to the borders of the geographical area of reference for all firms. The relative weight of outlet markets shifted, producing a new balance, and the importance of individual areas of production changed dramatically. The expansion in new markets is being accompanied by the establishment and consolidation of new areas of production, and new destinations for FDIs. In the automotive industry Western Europe and North America lost weight in favour of Asia (and especially China), which became the third largest producer of motor vehicles in 2006, overtaking Germany (CCIAT, 2007), Western Europe and South America.

According to the World Trade Organization: "In the production of an 'American' car 30% of the car's value originates in Korea, 17.5% in Japan, 7.5% in Germany, 4% in Taiwan and Singapore, 2.5% in the U.K., and

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<sup>1</sup> The expression "*The world that changed the machine*" overturns the interpretation at the beginning of the 1990s of "*The machine that changed the world*" (Womack *et al.*, 1991) an important contribution, resulting from a study in MIT's International Motor Vehicle Program, which showed the "superiority" of the Japanese model of auto production and relationships with the supplier firms compared to the prevalent organisation of the larger North American firms.

1.5% in Ireland and Barbados. Only 37% of the production value is generated in the United States" (reported in Antras and Helpman, 2004, p. 553). The growth of vertical international specialisation has given rise to a thorough spatial reorganisation of the large auto assemblers and their suppliers, which goes beyond national boundaries, to create transcontinental supply networks. On the other hand, it is distinctive in the automotive industry to retain a strong home regional or local dimension. In fact, across countries the automotive industry is typically clustered in a few industrial regions (Sturgeon *et al.*, 2009). As a result, "local, national and regional value chains in the automotive industry are 'nested' within the global organisational structures and business relationships of the largest firms" (Sturgeon *et al.*, 2008, p. 8).

In Italy the expansion of foreign markets for the firms operating in the automotive chain accelerated at the end of the 1990s. This trend is the result of two effects. On the one hand, it was a reaction to the decreasing weight of Italian supplier firms in the strategies of FIAT Auto, the key player in the Italian automotive industry. In the 1990s, FIAT Auto created a regional industrial pole in Poland and extended its presence in Argentina and Brazil. As a result, with increasing volumes of production being provided by its foreign factories, the production of automobiles in Italy fell from roughly 91% of the total in 1989 to 64% in 1999 (Balcet and Enrietti, 2002) while in 2006 it accounted for 55% of global production. In addition to the increasing importance of the phenomenon of internationalisation of production, Italian sites of production shrank even further at the beginning of the 21<sup>st</sup> century, following the acceleration of the FIAT Auto crisis and severe loss of market share in domestic and international markets. On the other hand, the internationalisation of supplier firms was sometimes based on a co-location effect. In fact, FIAT Auto encouraged some "preferred" suppliers to relocate near to their foreign factories to ensure that FIAT could maintain its quality standards.

Thus, we observe a parallel internationalisation process: that of FIAT itself, and that of its suppliers. This parallelism, however, can hide different mechanisms: one that still links the local suppliers to their core firms, this time pushed by FIAT internationalisation strategies. The other one, based on a more independent internationalisation path of the SMEs, that take advantage of their agglomeration economies, partly severing their links with FIAT. We want to discover which type of response prevails in our case study.

To answer this question we use a set of firm-level data gathered by the Turin Chamber of Commerce, Industry, Agriculture and Handicrafts (CCIAAT, 2006) for a representative sample of 786 firms operating in the auto chain. The variables refer to 2005, which saw the end to the worst crisis ever for FIAT Auto, in over a hundred years of activity, and which the company seemed to overcome only in March 2005 (Berta, 2006). Unfortunately, it is not possible to compare these data with other waves, thus we need to exploit only the cross-section variability in the explanatory variables. As far as we know, however, this microdata set is unique in terms of its national coverage and level of detail on firms' characteristics. We frame our empirical analysis within a set of logit and multinomial logit models, where the dependent variable is, in turn, an indicator of Internationalization (Yes/Not) and an Index of Internationalisation Strategies (ISI, henceforth), while our core variables of interest are: (a) the shares of domestic sales to FIAT by the supplier as indicator of dependency from the core firm in the industry; (b) three versions of an agglomeration variable. After controlling for firms' individual characteristics and regional GDP (at NUTS 3 level), we find that the probability of internationalisation is positively correlated to all our agglomeration variables, while is inversely correlated to sales to FIAT. We also discuss the interaction between location and sales to FIAT in relation to different ISI modes. We conclude that there is a clear, statistically robust, agglomeration effect - and of a specific Turin district effect - sustaining internationalisation, and that this effect is currently independent of the vertical linkages between suppliers and the dominant car-maker. This finding is entirely new and has, as will well show, important and timely policy implications.

The structure of the paper is as follows: Section 2 presents our conceptual frame and research motivation; Section 3 describes the variables used in the empirical analysis; Section 4 reports and comments on the results and Section 5 concludes.

## 2. Conceptual frame and research motivation

Our research focuses on the relationship between internationalisation and SMEs firm's agglomeration in a 'hub-and-spoke' district. We first discuss below some issues in the internationalisation literature that are of

interest for our analysis; secondly, the specific mechanisms that link internationalisation and geographic clustering around a large firm.

In the past two decades internationalisation has become a central process in firms' strategies and has emerged in many and complex forms. The strategies include exporting through traditional distribution channels, investing in commercial penetration of foreign markets, technical agreements and foreign direct investments (FDIs). In some cases, these strategies appear to be complementary rather than substitutable in nature, but firms widely differ in their abilities to identify and implement the best combinations (Basile *et al.*, 2003). The international fragmentation of production, as discussed by Venables (1999) and Jones and Kierskoswski (2000) and by a wide related literature, can take an 'horizontal' or a 'vertical' dimension: in the former case FDIs are instrumental to replicating in new geographical contexts of the existing production arrangement in order to serve new markets; in the latter case, the value-chain is deeply restructured, as the parent company does not just replicate elsewhere its previous structure, but actively looks for alternative suppliers in order to minimise procurement costs.

The international fragmentation of production affects all industries, from textiles to aerospace (Feenstra, 1998; Hummels *et al.*, 2001; Antras, 2003; Antras and Helpman, 2004). The extension of the supply network to the international scale has been facilitated by the diffusion of information and communication technologies (ICT). However, since the mid 1990s, direct investments by multinational firms have played an important role and, increasingly, are fragmenting production across different productive sites. The automotive industry is a particularly important example of this process (Humphrey and Memedovic, 2003; Sturgeon *et al.*, 2008).

The large and diverse participation of manufacturing firms in foreign markets since the beginning of the 1990s has been accompanied by a new wave of theoretical and empirical literature that throws new light on the nature and determinants of the internationalisation process. As it has been widely recognised, in the second half of the 1990s there was a significant break in the until then accepted interpretation that the variables explaining the presence of firms in international markets were mainly attributable to the traditional determinants of comparative advantage at country level, industry characteristics, commercial barriers and

transport costs. The contributions of Bernard and Jensen (1995, 1999, 2004a, 2004b) and Helpman *et al.* (2004) highlight that, even within the same industry, there are exporting and non-exporting firms according to several firm-specific characteristics. According to this view, there is a systematic relationship between firm characteristics and firms' participation in trade and international investments (Helpman, 2006).

The increased availability of micro panel data enables econometric analysis for different countries and different types of industry and confirms the theoretical predictions that the set of a firm's characteristics constitutes the main explanatory variables in the different modes of internationalisation adopted by firms. How firm's location plays a role in this context? There are two possibly competing views: geographical agglomeration is not important per se, but only because it supports the direct linkages between one (or very few) global players and their suppliers; alternatively, in a mature industry, geographical clustering offers to SMEs advantages that are largely independent from their relations with large firms. The former explanation of location advantages points to 'vertical' and structured relations, the latter to more 'horizontal' relations, i.e. to a Marshallian-district effect. Mariotti (2004) reviews several empirical studies on the relationship between the Italian industrial districts and the different forms of internationalisation. She observes that while FDI is the typical form of internationalisation for large-firms, either in the form of green-field or brown-field investment, the strategies available to SMEs are more limited, and take often the form of trade agreements, subcontracting, and to some extent de-localisation of some labour intensive activities. Thus, when we focus on an industrial district where there are both large multinational firms and many small-medium sized suppliers, the internationalisation opportunities open to the two types of firms are quite different. In a careful empirical study of Sweden's exporters, Malmberg *et al.* (2000) study the relation between export performance and agglomeration. They conclude that, apart from industry-specific factors and economies of scale (large firms export more), urbanisation is important, while localisation of similar firms in small municipalities does not have an important effect. They observe that : "Export performance is also promoted by the increasing scale of operation associated with urban agglomerations and corporate groups. The positive effect of a local leader firm indicates that increasing scale of operations has, in addition, a spillover effect on local export performance". They review a number of earlier research that questions the importance of pure agglomeration effects (in the form of geographical proximity) as a key determinant of

firm's performance, while suggest the role of "hub" firms and highly developed and diversified urban contexts. They also suggest that the empirical testing in this area has been in past times too extensively based on case studies instead than on econometric testing. While the data used by Malmberg *et al* (2000) were constrained by just one simple internationalisation indicator, we are interested in a wider range of internationalisation patterns, and in their relationship with polarisation (around a large firm), agglomeration (geographical density of similar firms), urbanisation (being located in a rich metropolitan context). More recently, Press (2008) discusses through a simulation model the pros and cons of hub-and-spoke clusters versus flexible specialisation as industrial arrangements to cope with internationalization, and compares the different adaptability of Italian industrial districts and the Silicon Valley-Boston 128 case.

The automotive industry constitutes a privileged point of analysis for our research question. Since the late 1980s, the automotive industry has felt the full force of globalisation in the market for intermediate and finished goods, while retaining a strong local structure, which is in contrast to other industries which have fully developed global-scale patterns of integration (Sturgeon *et al.*, 2009). This pattern is particularly important when we consider the Italian automotive supply-chain as a case study. Before moving to our conceptual framework, it is worth briefly mentioning some facts.

FIAT Group (the acronym stands for Fabbrica Italiana Automobili Torino, founded in 1899) has a century long history of association with the Turin area, located in the North West of Italy, and historically the cradle of political unification process of the nation in the XIX Century (the capital-city of the kingdom of Italy until 1864). Certainly FIAT has been the most important example of the Fordist mode of production in the country (first assembly lines in 1912, three years after the launch of the T model by Ford), and hosted one of the core concentration of technological skills in Italy. After WWII, (and a troubled history connected with its role as one of the main supplier of military equipment for the government), FIAT specialised in small, relatively un-expensive cars, well suited for the fast growth of a large number of customers with modest but adequate income. In the 1970s FIAT was a large vertically integrated company, producing more than 1,600,000 car per year, mostly in Turin, where 80% of industrial employment was in the automotive sector. The process included the production of steel and of most of the components of the car. After the crisis of the Fordist paradigm, and years of industrial action by the powerful local trade unions, FIAT substantially outsourced

the production of components. At the same time it acquired virtually all its domestic competitors: Lancia, also in the Turin district; Alfa Romeo and Innocenti in the Milan province, Ferrari in Modena. Enjoying protracted political protection by subsequent government, that partially sheltered FIAT by international competition and offered substantial subsidies to investment, the car-maker was also able to open green-field plants in other Italian regions, particularly in the South (Melfi plant in 1993) and gradually to expand abroad its production capacity. During this process the FIAT plants in Turin were down-sized, and large-scale local subcontracting was developed as well, often to spin-offs owned by former employees, see Enrietti and Withford (2005). At the end of the 1980s FIAT had around 59% share of the domestic car market, but also a remarkable 15% of the European market. While at the beginning of the 1980s around 50% of the value of the production was sub-contracted, after a decade around 65% of the value of production was supplied by external firms. As Balcetti and Enrietti (2002) have noticed, the change of FIAT from a vertically integrated Turin-based company into a post-Fordist multinational had a dramatic impact on the Turin area. Gradually, the industrial district evolved from a quasi-monopsonistic relationships between the core firm and its suppliers to a more complex pattern. For example some car-design firms, that used to work for FIAT only, started to sell services to FIAT competitors abroad (being virtually all domestic competitors disappeared as independent entities). The best graduates of the local universities, notably in engineering, considered alternatives to joining FIAT and this enriched the local texture outside the traditional pattern of knowledge concentration in the dominant car-maker. At the same time, FIAT, partly following the Japanese-style supply chain model, and facing increasing competitive pressure from abroad, dramatically shrink the number of its direct suppliers in the region, from more than 1200 in the 1980s to around 350 at the end of the 1990s. At the beginning of this century, only around 30% of FIAT Italy-made cars are produced in the Turin area, while now important FIAT Group or related companies plants exist in Poland, Brazil, China, etc, including recently in Detroit (Chrysler). Excluding the latter, around 50% of FIAT 220,000 employees are currently located abroad.

Does this internationalisation process of FIAT spur a similar process among its suppliers? In Figure 1, using the data collected by the Italian institute of statistics (ISTAT) in 2006, we show the picture of geographical distribution (at province NUTS 3 level) of employees in the automotive sector. Looking into the location of

the automotive supply chain in Italy, it is apparent that the Turin district still holds a very important position, with 28.4 percent of the total amount of employees in the automotive sector. In fact, despite relocation of most of FIAT production elsewhere in Italy (and abroad), the only considerable automotive industry district is still in Turin. There are however other smaller clusters of suppliers in other provinces, obviously located around other FIAT plants. As shown in the figure, the provinces of Naples and Potenza, with the two Fiat establishments of Pomigliano d'Arco and Melfi, respectively, together with the historically important and already mentioned provinces of Turin, Milan, and Modena account for more than 50% of the total distribution of employees in the sector.

Figure 1 about here

In our empirical analysis we shall take advantage of the firm-level information we have, including location, to answer the question. Before moving to the details of the empirical analysis, we need to spell out the working hypotheses we want to test. We have in mind a simple conceptual framework, or stylized history, of the relationship between internationalisation and the “hub-and-spoke” pattern.

a) Domestic Market Strategy (DMS): In the traditional Marshallian district, in principle, firms in an industry are relatively homogeneous (Marshall, 1920; Becattini, 1987 and 2004). The blending of collaboration and co-operation between economic agents of comparable status (small and medium-size firms) guarantees the district the productive efficiency typical of a competitive market, together with the advantages accruing through co-operative relations among agents. In a cluster polarized around a large firm there is a fundamental hierarchy and thus asymmetry among firms. The core firm typically enjoys economies of scale and of scope, hence greater productivity, has greater access to high quality human capital, to finance, and to international markets than its local suppliers. We consider this fact as given, even if in principle one cannot exclude the possibility of different evolution (for instance if one local supplier becomes global player in one specific component). The co-evolution of the large firm and its suppliers in one geographic district is ensured by mutual advantages. For example, in manufacturing industry geographic proximity between a large customer and its supplier is an advantage when

transportation costs of components in the supply chain are non-negligible. Moreover, when contracts are incomplete, i.e. cannot be specified in all their details, transaction costs are decreased by frequent informal contacts between the managements of suppliers and car-maker. Exchanges of human capital between the two sides of the market, and the sharing of local cultures and values (e.g. the role of reputation and trust) increase the efficiency of the procurement market. Given the asymmetry under DMS, the core firm acts as the main catalyser and the growth engine of the co-evolution process, an engine driven by “the visible hand” of a large firm. In other words, it is the “hub” that transmits momentum to the “spoke”, but the whole wheel remains connected by the efficiency of this form of division of labour.

- b) Complementary Internationalisation Strategy (CIS): Internationalisation of the “hub” firm changes the previous district co-evolution pattern in a fundamental way. As the large firm’s strategy is now less focussed on the domestic market, it has an incentive to invest abroad and to re-locate part of its production and managerial capacity. As the domestic market grows at a slower pace than markets abroad, the growth engine is now gearing at a higher speed elsewhere than in the traditional district. The domestic “spoke” structure becomes less critical to the “hub”. The response of the suppliers can be either to close down or to adapt. One adaptive response to the challenge posed by the internationalisation of the core firm is to “follow” it abroad. In turn this can be done in two ways, either simply by exporting components to the foreign plants of the core firm (CIS/export), or by investing abroad (CIS/investment) following the customer (co-location) in order to preserve in a new location some of the advantages of proximity. Both CIS responses exploit strategic complementarity between ‘hub’ and ‘spoke’ firms, but are costly for the latter: in the first case (CIS/export), transportation and other costs will play against the now distant supplier, hence a squeeze of margins is needed to remain competitive; in the second case (CIS/investment), sinking capital abroad for a SME may have an impact on scarce managerial and financial resources.
- c) Substitutive Internationalisation Strategy (SIS): A fully or partially different response from (CIS/export and CIS/investment) is a progressive break in the “hub-spoke” relations, with the suppliers moving away from the former “hub” and independently looking around for alternative outlets. This is certainly

a dramatic change of perspective, and the question arises whether this strategy is feasible for the SMEs suppliers given the asymmetry in a DMS environment, where we assumed that the local firms are constrained in their growth opportunities. Here, however, the agglomeration effect, independent from the “proximity to the hub” effects plays a role. After all, while the core firm was instrumental in generating the district, when it partly moves away (or in an extreme – but realistic - case shuts down its local operations) the local firms are still potentially there. Maybe not all of them, but those in better conditions can capitalize now on their mutual proximity, instead of the proximity to the former “hub”. Competitors of the core firm know that some of its suppliers are clustered in a certain region, and share skills, knowledge and have lost part of their traditional market (Cainelli and Zoboli, 2003). Cooperation between local firms to serve a new distant customer can regenerate Marshallian-type district economies.. Moreover, while, let us say FIAT moves to China and looks for suppliers there, maybe a Chinese global player is looking around for where off-shoring in Italy, and the existence of a former “hub-and-spoke” district may be an opportunity.

To sum up: the internationalisation of a polarised geographical district follows from the internationalisation of the core firm, who is the first mover in the game. The suppliers must then adapt to the new situation or disappear. They can either move as literally followers in the spatial dimension, either moving capital and management in the new locations of the core firm, or they can try to reverse the ‘hub-and-spoke’ district in a Marshallian district. As long as the “hub” is still there, they can try a combination of the two responses. While not everybody is a winner in this game (the weakest supplier disappear, some followers may suffer shrinking returns on their investment), there is a chance of a successful restructuring of the supply chain towards a more open and less vulnerable industrial district.

Thus, we want to analyse whether, in the specific case of the Italian automotive supply-chain, mostly centred around the Turin district, and in some minor geographical clusters, the firms that we can observe<sup>2</sup> are taking either the “large-firm dependent” internationalisation route (CIS) or the alternative route (SIS) or if they are

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<sup>2</sup> Unfortunately we cannot observe firms that did not survive the adaptation process.

still stuck in their traditional role of local, non-internationalised suppliers under (DMS). This lends itself to a multinomial logit modelling, as we shall discuss in the next section.

Testing DMS against CIS+SIS is straightforward: what we need to do is just to see whether the probability of being a non-exporter is positively correlated to sales to FIAT, after having controlled for other factors, including location. Italy, from this point of view, is a nearly perfect laboratory, being FIAT the only car-maker in the country. Testing SIS against CIS needs to look whether being located in a 'dense' district is an advantage, conditional to the degree of dependence from sales to FIAT. We shall use three different ways to capture the agglomeration effect (firms' density, employment density, and given our specific case study a Turin district dummy). As our results with the three measures are very similar, and better for the Turin effect, in our final test we use an interaction term between the Turin dummy and the sales to FIAT as proxies respectively of the agglomeration and the "hub-and-spoke" effect. We have insufficient information, however, to discriminate between CIS/investment and SIS. In fact, given our conceptual frame, ideally we would need to know if the foreign investment abroad by the supplier is located 'near' FIAT or 'near' a competitor. In some cases even this information would not be enough as in some countries different car makers locate their plants in the same district and share some suppliers (Detroit is a clear example). Nevertheless, we discuss qualitatively this specific aspect and offer our interpretation of the empirical findings.

### 3. Data

The Turin Chamber of Commerce (CCIAAT) collects information through direct surveys to firms. Our dataset, based on the 2005 survey, consists of a representative sample of 786 firms in the automotive chain, out of a universe of 3,854 firms in Italy in that year. Here below we discuss the questionnaire and the data used in our empirical analysis. First of all, however, it is relevant to verify for the representativeness of the sample, especially in terms of the spatial distribution of firms and employers in the automotive sector. We compare the data in our sample with those collected by the Italian institute of statistics (ISTAT) for the

Italian economy in 2006. A simple correlation analysis between the sample and population values reveals that the number of firms and employers for each Italian province have a correlation of 0.950 and 0.954, respectively. In terms of the geographical distribution of firms and employers, hence, our sample thus represents a very good approximation of the overall Italian situation concerning the automotive sector.

### 3.1 Internationalization strategies

The CCIAAT questionnaire included questions about: turnover from foreign sales; the main forms of commercial presence abroad (own sales network; having an agent abroad; trade agreements; selling from Italy); the presence of factories abroad - owned or co-owned by the supplier firm. These information allow us to construct two simple qualitative indicators concerning the internationalization strategies pursued by the firms. The first one, that we name **Internationalisation**, is a dummy variable assuming unit value if the firm undertakes whatever form of internationalization. The latter, that we call **ISI**, distinguishes between different combinations of internationalisation strategies. In particular, in addition to the previous indicator, we allow for two possible internationalization strategies: i) export without any business organisation abroad; ii) internationalisation which includes export plus investment in a business organisation abroad, where by business organisation we understand either a sales network/structure or foreign direct investments (FDI). Table 2 presents the **ISI** indicator and, based on the questionnaire responses, the absolute and percentage frequency for each internationalisation mode.

Table 2 about here

Several interesting features emerge from the data: a) 37.0% of firms have only a domestic outlet, and are unable (or even unwilling) to sell their products abroad; b) internationalisation of Italian automotive supplier firms is mainly in the form of exporting, without even the presence of an agent abroad (39.3%); c) exports enhanced by penetration operations or FDI is adopted by 23.7% or, in other terms, 186 out of 495 firms active in foreign markets.

We consider these data as a first evidence that the strong majority of firms operating in the automotive supply chain are active in the international markets. Moreover, a significant share of these firms are non just exporters of goods, but have invested abroad either in marketing or in production.

### 3.2 The district of Turin and firms' relation with FIAT

Given the research question discussed above, two potential drivers of internationalisation need to be measured or proxied with particular attention. The first one concerns the choice of appropriate measures of the geographical agglomeration, while the second relates to the business relation between each supplier and FIAT.

About the former, in the empirical literature there is not a univocal approach to account for geographical agglomeration and, based on the nature of the analysis, different measures have been proposed. In some cases the agglomeration effects are measured by non sector specific indicators such as population density or employment in the manufacturing sector (Coughlin *et al.*, 1991, and Wei *et al.*, 1999). Other studies, instead, include sector specific indicators. Braunerhjelm and Svensson (1996), for example, use a sector specialization index while Head *et al.* (1994, 1995), in investigating the FDIs, concentrate on the number of foreign firms for a determined sector located in each region. Given the specific focus of our research, it seems appropriate to use sector-specific indicators for the geographical agglomeration. The first indicator we are going to use is a density measure and is calculated as the ratio between the number of workers in the automotive sector for each province divided by the area of the province (**Employment Density**). This indicator reveals that the province of Turin, as expected, presents the highest density (6.68 workers per square km). High density values also emerge for the provinces of Naples (5.97) and Milan (3.74). This result, as explained before, is not surprising and strongly depends on the large number of workers employed in the FIAT plants in Pomigliano d'Arco (Naples) and Arese (Milan). All other provinces present density measures notably lower than these mentioned cases<sup>3</sup>. A very similar measure of agglomeration, that does not significantly alter the picture, has been calculated as the ratio between the numbers of firms in a province and the area of the province (**Firms'**

**Density**)<sup>4</sup>. A third indicator, instead, simply refers to the province of Turin, given its unique historical role as the Italian automotive district. This indicator, thus, is represented by a dummy variable (**Turin District Dummy**) that takes on a unit value if the firm is located in the province of Turin, and zero otherwise. As we will see, despite the simplicity of this naïf indicator, does not provide poorer results with respect to the two density indicators presented before, and more frequently adopted in the empirical literature. We do not have information to support a further set of indicators based on linear distances among locations or firms, but we do not think that in our perspective this is a problem, as we are not interested in spatial econometrics, e.g. focussing on the measurement of Marshall-Arrow-Romer (MAR) economies. Clearly, in a country where there is one car maker only, with well identified location of its plants, and when the focus is on a specific industry, there is a trivial answer to where the geographical clusters are located. Thus the province based (NUTS3) density data that we use, and even the simple Turin district dummy work well in this specific country/sector context. Moreover, geographical distances per se may contain an important aggregation error and may be misleading because of the non-stochastic nature of the administrative boundaries, as discussed by Cainelli and Lupi (2008). Our density measures suffer from a similar problem, but we do not think that this is of any importance in our context. When we say that an automotive supplier is located in Turin, it means that it is “in the district”. The error made in not considering a small number of suppliers close to the borders of the province does not seem important to us. When, instead we use the above mentioned standard density variables, basically we enlarge our agglomeration scope to the Naples and Milan (minor) automotive districts (and in principle we allow for greater variability in the sample data).

The second aspect that deserves a particular attention is the business relation between each supplier and FIAT. One of the CCIAAT survey questions asked the percentage of domestic sales related to FIAT Auto or to suppliers of FIAT Auto (**Sales to FIAT**). Thus this variable is broad in scope, as it covers both domestic direct and indirect sales to FIAT, provided that the component in the end is assembled in a FIAT car.

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<sup>3</sup> The difference between the values of employment and firms’ densities registered for the province of Turin and all other provinces could be even larger if we consider that almost half of its territory is constituted by mountains.

<sup>4</sup> The two density indicators have been calculated based on the entire population of firms in the automotive sector, and refer to the Italian institute of statistics (ISTAT) investigation in 2006.

Moreover, in order to control for other possible specific province effects, we include the log of per capita GDP at province level (**Per Capita GDP**).

Here below we describe all the variables included in the regression models for controlling for firms' dimension, performance, and other structural characteristics.

### 3.3 Firm characteristics

From the data based on the responses to the questionnaire we derive two indicators related to firm size. The first refers to numbers of workers (**Employment**); the second refers to turnover for 2005 (**Turnover**). We also have information on firm performance compared to the previous year (2004). As the questionnaire referred to ranges of values, we create a variable (**Turnover Growth**) based on the mid point for the categories in question.

A third firm characteristic is whether or not it belongs to a group. We created three dummy variables that specify the position of the firm within the group: **Parent company**, **Subsidiary** of another Italian or foreign firm, or **Independent**, i.e. not belonging to any group.

The questionnaire responses provide interesting information on firms' imports, which can be seen as a relevant aspect of internationalisation. In principle, we could create dummy variables to identify types of imports e.g. raw materials; intermediate goods; services; finished products; other goods. However, because of missing data, we decided to create a single dummy (**Import**) that takes on a unit value if the firm imports and a zero if it does not, regardless of the type of goods imported.

We also have data on the amount of turnover invested in R&D, which is measured by the variable **Research**. Moreover, we are able to discriminate for firm's research support structures, and we created dummy variables to indicate **University Research Centres** (Italian or foreign), **Public Research Centres** (Italian or foreign), **Private Research Centres** (Italian or foreign), or **Private Research Centres** (Italian or foreign).

The CCIAAT dataset has another potentially attractive feature in that it breaks down the automotive chain in four segments related to the nature of the output. These are: **Specialists**, module and systems makers

(**Modules-systems**), engineering and design firms (**Engineering-design**) and **Subcontractors**. We thus created one dummy variable for each types.

The share of turnover generated by the automotive market and by the commercial vehicles markets is interesting in terms of firm outputs as it conveys information on firm's specialisation. In order to account for this aspect, we created three dummy variables to indicate a low, medium or high level of sales on the auto market (**Low auto market**, **Medium auto market** and **Top auto market**, respectively). All the variables are summarized in Table 3 in the Appendix. Table 4 shows the cross correlations among some of the firm characteristics. As expected the three measures of agglomeration are highly mutually correlated. While this is obvious between the two density measures, what is not obvious is the correlation between such two variables and the **Turin District Dummy**. This result provides further evidence on the assumption that in Italy the core district in the automotive sector is represented by the Turin province.. Interestingly, the **Sales to FIAT** variable appears to be negatively and significantly correlated with **Export**, the percentage of turnover from foreign sales. Looking at the structural characteristics of the firms, as expected, the two measures of firms size, **Turnover** and **Employment**, are highly correlated. Less obvious are the positive correlations between the share of **Sales to FIAT** and **Turnover** and **Employment**. As mentioned, we use these variables as individual controls, as our main variables of interest are **Sales to FIAT** and the three agglomeration proxies.

Table 3 and Table 4 about here

## 4. Empirical analysis

The empirical analysis is in two steps. The first one accounts for the different behaviour of firms in deciding whether to internationalize or not, with particular attention to their commercial relations with FIAT and the belonging to an automotive district. The second step, instead, concentrates on the different ways of internationalization. We discuss below our strategy.

## 4.1 Domestic-oriented versus internationalized firms

The first step of the empirical analysis takes into consideration the hypothesis that being located in a district and having commercial relations with the hub of the district potentially influence the binary response: being oriented to the domestic-market only or being active in the international market in any form. This corresponds to testing hypothesis DMS versus CIS+SIS as discussed in Section 2. The analysis is performed by specifying and estimating a logit model<sup>5</sup> for the **Internationalisation** dummy as dependent variable. Among the regressors we include the three indices of agglomeration (one at time because of the strong correlation between the three variables) and the variable describing the sales to FIAT, together with a set of other regressors playing the role of control variables. The results, for different measures of agglomeration, are reported in Table 5. In particular, regression (1) includes the variable **Turin District Dummy** as our crude indicator for geographical agglomeration, while regressions (2) and (3) refer to the two density indicators, **Employment Density** and **Firms' Density**, respectively. In all specifications we include, together with the agglomeration index and the **Sales to FIAT** variable, information on the size and economic performances of the firms plus other firm specific structural characteristics.

Table 5 about here.

In all the empirical models, the results are extremely robust. We find a positive and significant coefficient for all the agglomeration indexes, and a negative and significant one for the **Sales to FIAT** variable. In other words, being located in a district enhances the probability of a firm to internationalize but, at the same time, having strong business relations with the hub in the district undermines the spoke internationalisation. This result, as far we know, is entirely new in the empirical literature on polarised clusters, and suggests that firms in the urban industrial district of Turin (or in the other minor clusters) have an internationalisation advantage as relative to 'out of the district firms', and certainly the advantage is not because they are 'spoke' closely connected to the 'hub'. In fact, the suppliers are more successful in internationalizing when their business relation with FIAT is weaker. One subtle interpretation issue arises in this context: we cannot fully

exclude reverse causality. In other words it may be the case that as firms that internationalise are successful, then the share of FIAT in their turnover is less than otherwise. While this may be the case, it is important to stress that all the individual characteristics, including performance and other structural indicators, act as controls in the estimation. Thus, whatever the sequence of the story, the message of the opposite effects of agglomeration and direct supply to the core firm is confirmed.

## 4.2 Internationalisation strategies

In this second step of the empirical analysis we are interested to test whether, and in which way, the two different alternative responses of suppliers to the internationalisation of FIAT are working in the Italian supply chain, based on our discussion in Section 2. In what follows we label the CIS-type response as complementarity between the internationalisation strategies of FIAT and of its suppliers, while we label as substitution of sales to FIAT the SIS-type response. In principle, each firm can try to implement both strategies, but we want to see which response prevails in our representative sample of firms. The analysis is carried out by specifying and estimating a multinomial logit model, in which the dependent variable is the **ISI** indicator that, as previously described, summarizes the three possible combinations of internationalization strategies<sup>5</sup>. In other words, the internationalization modes investigated in the empirical exercise are: a) no internationalization; b) exporting without an organisation abroad; c) exporting combined with some commercial penetration abroad and FDI. We suggest that while the first situation (DMS), as already seen in the previous section, implies that the firm is stuck in its traditional role of supplier of FIAT in the domestic market, the second one (CIS) is a form of passive adaptation, while the third one (SIS) is more pro-active and it envisages a potentially change in the hierarchical relation between the core firm and its supplier. In fact, as mentioned in section 2, we cannot fully exclude that a firm that exports without any commercial or production structure abroad is actually diversifying its portfolio of customers or, respectively, that some investment abroad are related to co-location with FIAT plants abroad (our CIS/investment

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<sup>5</sup> For a detailed presentation of this type of model, see e.g. Greene (2008).

response). Qualitative evidence that we have collected and extensively reported elsewhere, (see Castelli *et al.* 2008) strongly suggests that firms that just export their product abroad, without a minimum of investment in creating a marketing or production organisation, are still likely to be linked to FIAT international strategy. In contrast, it seems reasonable to conjecture that firms that invest abroad are more ready to diversify their portfolio of clients.

Concerning the multinomial logit model, originally proposed by Nerlove and Press (1973), it can be thought as a generalization of the standard logit model, in which the number of possible choices is larger than two. More precisely, in our case we have  $J=0,1,2$  possible choices and the associate probabilities can be modelled as

$$P(Y_i = j | x_i) = \frac{e^{\beta_j x_i}}{1 + \sum_{k=1}^J e^{\beta_k x_i}} \quad \text{for } j=1, 2, \dots, J \quad \text{with } \beta_0=0$$

where  $x_i$  is the vector of regressors observed for the individual  $i$ , and the condition  $\beta_0=0$  is a necessary normalization for identification. The model, as it is written, implies that the odds ratio  $P_j/P_k$ , for any two choices  $j$  and  $k$ , does not depend on all the other alternatives. This hypothesis, indicated as Independence of Irrelevant Alternatives (IIA), is necessary and sufficient for a correct specification of a multinomial logit model but generally results to be extremely restrictive in terms of the economic interpretation of the different behavioural choices. In our context, in particular, it states that the expected profits of any two different internationalization modes are independent. Of course, if we consider the two alternatives  $ISI=1$  and  $ISI=2$ , both of them include exporting as a particular internationalisation strategy, and the assumption of independence reveals to be questionable. In order to test for the correct specification of the multinomial logit model, in each regression we perform the Small-Hsiao test for the IIA null hypothesis, against the alternative that at least one alternative is not independent<sup>7</sup>. As can be seen in the Table 6 and Table 7 below, for all specifications the null hypothesis of IIA cannot be rejected at a ten percent critical value.

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<sup>6</sup> In a previous version of the paper we considered all the possible combinations of internationalization strategies, such as export, commercial penetration, and FDI. However, due to the small number of cases for some of each we preferred to move to the aggregation reported in Table 2. The results, however, were extremely robust to those reported in this version of the paper.

<sup>7</sup> This test, proposed by Small and Hsiao (1985), is an improvement, both in terms of asymptotic and computational properties, of the traditional test developed by Hausman and McFadden (1984).

The results of the estimation procedure, in terms of marginal effects, are presented in Table 6. In particular, the first three columns refer to the **Turin District Dummy** as indicator for agglomeration, the second three columns refer to the **Employment Density** indicator, while the last three are associated to the **Firms' Density** indicator<sup>8</sup>.

Table 6 around here

Concerning the two variables of interest (agglomeration index and **Sales to FIAT**), we find that location of the firm in the industrial district has a clear and statistically significant positive impact on the probability of internationalisation. This result is robust to the different measures of agglomeration, as reported in the mentioned table. In particular, the coefficient is negative and significant for  $ISI=0$  (no internationalization), while it is positive and significant for those firms using mode 1 (exports without business structure abroad). For the other form of internationalization ( $ISI=2$ ), instead, the coefficients appear to be statistically significant only when we include the **Firms' Density** indicator. As a first comment, given the relatively fixed nature of location in the mid term, and  $ISI$  choices (e.g. because of the time needed to implement FDI or build up a distribution network) the variability across firms here is sufficiently informative, although the analysis just uses a cross-section of data. Being in Turin definitely increases the probability to internationalise. But is this because of the close business relationships with the dominant local car-maker?

The coefficients of the variable **Sales to FIAT** are all negative and are statistically significant<sup>9</sup> for modes 1 and 2 while it is significant and positive for  $ISI=0$ . Having strong ties to FIAT reduces the probability of choosing internationalisation, while strongly increases the probability of remaining confined in the national trade ( $ISI=0$ ). This confirms the previous result. But now we are able to say more about the remaining options open to the suppliers.

Combining these results we find that location in the district of Turin promotes internationalisation for firms in the automotive supply chain, but is not because of a FIAT-effect. In fact, being geographically close to the

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<sup>8</sup> In order to improve the efficiency of the estimators, with respect to the results reported in Table 5 for the logit model, here we exclude all the regressors that are never significant for all values of  $ISI$ .

FIAT historical location in Turin area significantly *increases* the probability to decide to internationalise but being too much integrated with FIAT as a supplier *decreases* the incentives or opportunities to internationalise. This is a clear evidence of an agglomeration effect ‘around’ a large firm (the hub), possibly originating in spin-offs and spill-overs of knowledge from the large firm to its suppliers, but this agglomeration effect is currently independent of direct business linkages. In fact, firms in the automotive supply chain that internationalise should not be overly dependent on sales to their historical main customer.

In the next empirical exercise, instead, we try to shed some light on the two possible mechanisms proposed above (CIS and SIS) to explain the internationalization process conditional on agglomeration and relation with the hub firm effects. In order to test for these two possible interpretations, we specify and estimate a multinomial logit model of the type discussed above, where however we include a further variable which is the interaction term between **Sales to FIAT** and **Turin District Dummy**. The intuition is that, in general, being located in the province of Turin enhances the process of internationalisation, but the consequences of the ties with FIAT might be different whether or not the firm belongs to the automotive district. In particular, in the case of “pure” complementarity, the firms in the district of Turin may directly export to the foreign subsidiaries of FIAT or serve it through their own foreign affiliates. As we have seen, in fact, the FIAT Group is a largely internationalised firm, with a number of large production plants in Poland, Brazil, China and in several other countries. This might imply that suppliers that are more closely integrated with FIAT are pulled abroad by the car-maker through co-location or other co-ordinated forms of operations. This relation, of course, should be more problematic for firms not belonging to the production district, hence are more ‘distant’ from FIAT. In this context, we expect a positive and significant coefficient for **Sales to FIAT – Turin** in correspondence with **ISI=0**, while negative and significant coefficients for the same variable in correspondence with the other values of **ISI** indicating internationalisation. At the same time, we expect not significant coefficients associated to the **Sales to FIAT – NoTurin** variable. Actually, these conjectures are only partially accepted by the empirical analysis reported in Table 7, for the three different indicators of agglomeration included in the regressions.

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<sup>9</sup> Actually, for **ISI=1** the Sales to Fiat coefficient is significant only when we use the Turin District Dummy variable. However, for the other two cases, the sign is as expected and the pvalue is only slightly above the standard 10% critical value

Table 7 about here

The corresponding coefficients for the **Sales to FIAT – NoTurin** are more significant and larger in magnitude with respect to those referring to the firms in the Turin district. At this stage, this result is not at odd with the complementarity assumption, but casts some doubt about the possibility of an additional explanation. However, testing if such alternative explanation were the above mentioned substitution mechanism is not immediate. Some evidence can be found however looking at the different strategies of internationalization. In fact, if the complementarity effect is relevant, one might expect that the suppliers export directly to the foreign subsidiaries of FIAT without the need for commercial penetration (i.e. **ISI=1**). However, when the substitution effect is relevant, commercial penetration or other forms of structure abroad might be more necessary, since the suppliers address to new and unknown customers (**ISI=2**). Observing the estimates in Table 7, it seems that for the firms belonging to the district of Turin, the only significant strategy is the one associated to **ISI=2**, i.e. export combined with investment abroad. This result is a further confirmation about the weakness of the complementarity assumption. On the contrary, for the firms not belonging to the Turin district, the coefficients associated to **ISI=1** (export) and **ISI=2** (export and other structures abroad) are both significant and with correct signs. Taking together all the results, we can conclude that both the complementarity and substitution mechanisms work, but the former seems to be rather weak. In a nutshell, firms located in Turin and with now less strong business relation with FIAT are also the front-runner of the most advanced forms of internationalisation.

## 5. Concluding remarks

This paper contributes to the literature on the ‘hub-and-spoke’ district by revealing that internationalisation of the ‘hub’ may fundamentally alter its relation with the spoke. Geographical proximity of firms in the

supply chain to a core firm does not imply that internationalisation of the latter determines that of the former.

The spoke may gradually become less dependent from the hub and then recur to the benefits of agglomeration in order to play its own game, i.e. serving the competitors of the former hub. This game is of course not for all. Looking to the individual firm's characteristics different from location, company size is a highly significant explanatory variable and particularly when exports are not the only activity in foreign markets and more complex modes of internationalisation, such as FDIs, are adopted. In general, this correlation can be explained by the fact that these activities are subject to scale and scope economies and have higher levels of sunk and fixed costs. In the case of automotive industry, the largest suppliers have become global suppliers with multinational operations, and supply goods to a wide set of lead car assemblers.

Second, exporting and importing are complements. By importing raw materials, intermediate goods, services, and finished goods it is possible to reduce internal production and coordination costs. In order to qualify this result, we can compare our findings with more recent data from the CCIAAT (2006). According to the CCIAAT (2006), the volume of imports of firms in the supply chain is small: roughly half of these firms do not purchase anything from foreign markets, and the remainders only purchase raw materials and semi-finished goods; moreover, although the degree of vertical integration of the firms is low, the quota of purchases from abroad is also low, less than 25% of total purchases. On the whole, it would appear that imported goods are standard supplies, with low levels of investment and, for this reason, from a transaction cost perspective, are the subject of arm's length contracts. On the other hand, this implies that trade is "strongly localised" since Italian subcontractors are still the privileged procurement channel based on quality. This is hardly surprising since, as pointed out in the literature on global value chain analysis, "capabilities are bundled within firms, as well as localities, and that local and distant linkages are not mutually exclusive, but part of a nested and increasingly integrated spatial economy that involves cohesion at all spatial scales, local, national, continental and global" (Sturgeon *et al.*, 2008, p. 6).

Third, we found mixed evidence for in house firm research and cooperation with universities and other public research centres. Location in Turin of a public university for engineering and technology (the *Politecnico*) and several research centres is a potential advantage for local suppliers, as such local institutions can be seen as important actors ensuring “supply externalities” to the enterprises. Nevertheless, firms’ products are possibly not very R&D intensive. Thus, our result points to a more generic location advantage in a highly developed urban context, than to one based on access to specific advanced research services.

Fourth, the search for customers other than FIAT Auto has a positive and highly significant impact on suppliers’ activities in foreign markets; this result confirms the results of other qualitative and univariate analyses (CCIAAT, 2006) and is an important result in the context of the Italian supply chain, which seems to be becoming less dependent on a single customer, FIAT.

We conclude that after controlling for firms’ individual characteristics and direct linkages with FIAT, localisation in the province of Turin has a significant and positive impact on the internationalisation of the firm. This result points to an independent agglomeration effect in Turin. In turn, this suggests that an ‘hub-and-spoke’ district may evolve into a Marshallian one, more related to human and social capital and the business climate. Being in Turin, but not too closely linked to FIAT, being not too small a firm, and being able to import some standardized inputs and locally organise their own supply chains, increases the chances that firms in the automotive supply chain will internationalise. It would be interesting to conduct a similar analysis for other car industry geographical clusters, in different countries, to test what might be a new stylised fact about internationalisation modes.

We briefly conclude with some implications for policy from our empirical analysis, which, in the context of the global crisis in the car industry that started in the second half of 2008, are particularly important. It may be true that supporting car-makers by providing capital subsidies or other forms of policy interventions (as it has been done in Detroit as in Turin), is also beneficial to employment and the turnover of some local suppliers, particularly those that adopted passive adaptation strategies. This type of support focussed on the hub-firm is, however, less beneficial to front-runners of independent internationalisation process. It might even have adverse effects as it distorts international competition from which the more independent

suppliers take advantage. If we are right in our interpretation, industrial policy in the long run should not focus too much on the direct linkage between the core firm and its suppliers. In fact, there may be a trade off between artificially preserving a car-maker's local procurement through targeted subsidies, and supporting the independent internationalisation of its suppliers. The most competitive suppliers seem to be less dependent on the local market and more interested in developing their own international strategy. Support for them would require a rather different industrial policy package, a package that should be tailored to their needs and not designed to steer them back to privileged business relations in the domestic market. In a different perspective, investing in local institutions and in those mechanisms that enhance local social capital and knowledge, particularly in a urban context, will help the regeneration of the flexible industrial district facing the crisis of the traditional hub-and-spoke environment.

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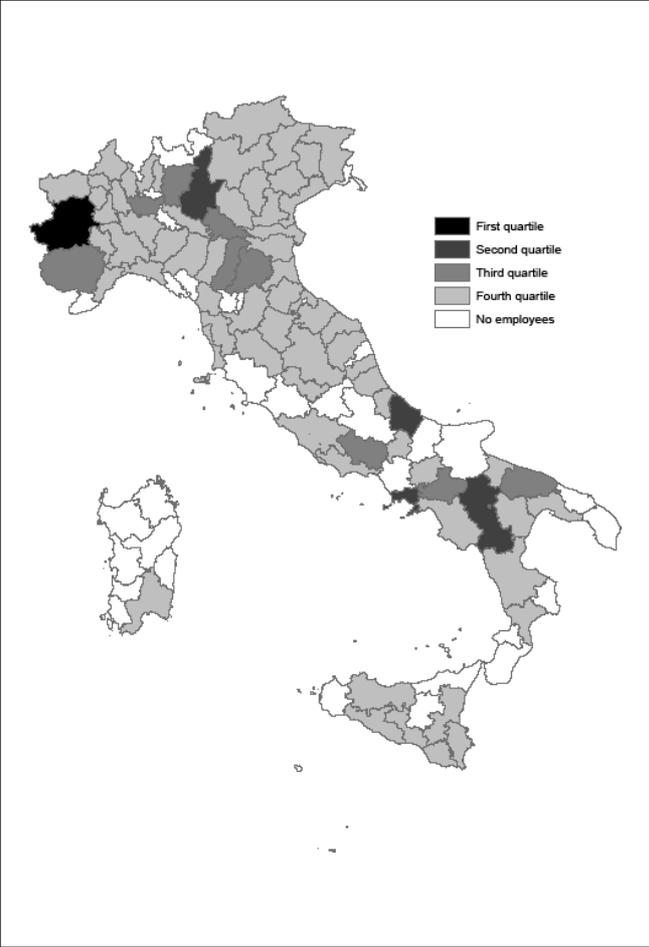
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# Appendix: Tables and Figures

Figure 1: Geographical distribution of employees in the automotive sector at province (NUTS 3) level.



Source: ISTAT 2006

Note : "first quartile" means that the black coloured provinces (Turin province only) accounts for around the 25% of the total amount of employees. "Second quartile" means that the dark gray coloured provinces and the black provinces account for around the 50% of the total distribution, and so forth for the other provinces.

Table 1: Some descriptive statistics of the sample

Aggregate Italian regions	no. of firms	Sales coming from the auto market (level)			Sales to FIAT Auto (level)			Firms with factories abroad	Exporting firms	Firms with commercial penetration abroad*	Firms that import**
		Low <25%	Medium 25%-75%	High >75%	Low <25%	Medium 25%-75%	High >75%				
North-East	76	7	5	64	69	2	3	6	48	20	49
Turin Province	289	26	61	202	179	85	24	17	200	52	170
Other North- West	206	17	28	161	168	27	10	23	141	48	140
Emilia- Romagna	79	3	6	70	73	6	0	6	47	17	43
Central Italy	81	3	7	71	63	7	11	3	33	12	48
South	41	2	4	35	25	5	10	1	16	5	20
Islands	14	2	1	11	12	1	1	0	3	0	6
<b>Total</b>	<b>786</b>	<b>60</b>	<b>112</b>	<b>614</b>	<b>589</b>	<b>91</b>	<b>101</b>	<b>56</b>	<b>488</b>	<b>154</b>	<b>476</b>

Turnover growth with respect to 2004	no. of firms	Number of workers	no. of firms	% of workers employed in factories abroad	no. of firms	Turnover in 2005 (million of euro)	no. of firms
Greater than 15%	121	From 1 to 9	177	Zero	742	Less than 1	135
Greater than 5%	247	From 10 to 50	383	Less than 10	12	From 1 to 2	139
Between 0 and 4%	217	From 51 to 250	147	From 11 to 25	10	From 2 to 10	255
Between 0 and -4%	112	More than 250	75	From 26 to 50	11	From 10 to 50	145
Less than -5%	44	-	-	From 51 to 75	4	More than 50	73
less than -15%	38	-	-	More than 75	4	-	-
<b>Total</b>	<b>779***</b>		<b>782***</b>		<b>783***</b>		<b>747***</b>

\* Commercial penetration= own sales network; having an agent abroad; trade agreements; selling from Italy.

\*\* Raw materials; imports of intermediate goods; services; finished products to be assembled.

\*\*\* The total is less than 786 because of non response in the corresponding questions.

Table 2: Internationalisation strategies: absolute and relative frequency for the different ISI values

<b>Internationalisation Strategies</b>	<b>ISI</b>	<b>no. of firms</b>	<b>Relative Frequency (%)</b>
No Internationalisation	0	291	37.0
Exports with no structure abroad	1	309	39.3
Exports with structure abroad and FDIs	2	186	23.7
Total		786	100

Table 3 - Description of Variables

GROUP OF VARIABLES	VARIABLES	DESCRIPTION
INTERNATIONALISATION (dependent variables)	ISI	See Table 2
	Internationalisation	Dummy =1 if the firm internationalizes
AGGLOMERATION	Turin District Dummy	Dummy =1 if the firm is located in the Province of Turin
	Employment Density	Workers in the automotive sector in a province divided by the surface of the province
	Firms' Density	Firms in the automotive sector in a province divided by the surface of the province
RELATION WITH FIAT	Sales to FIAT	Percentage of sales related to the FIAT Auto
STRUCTURAL CHARACTERISTICS	Employment	Number of workers
	Subsidiary	=1 if the firm is a subsidiary of another firm
	Independent	=1 if the firm does not belong to a group
PRODUCT CHARACTERISTICS	Innovative products	=1 if the firm produces an innovative product
	Mature products	=1 if the firm produces a mature product
POSITION IN THE AUTO SUPPLY CHAIN	Specialists	=1 if the firm is a specialist
	Modules-systems	=1 if the firm is a module and systems maker
	Engineering-design	=1 if the firm is in the field of engineering and design
LEVEL OF SALES ON THE AUTO MARKET	Low auto market	=1 if the percentage of sales is less than 25%
	Middle auto market	=1 if the percentage of sales is between 25% and 75%
	Top auto market	=1 if the percentage of sales is greater than 75%
R&D STRATEGIES	Research	Share of turnover invested in R&D
	University Research Centres	=1 if the research is conducted by the firm in association with Italian or foreign universities
	Public Research Centres	=1 if the research is conducted by the firm in association with Italian or foreign public research centers
	Private Research Centres	=1 if the research is conducted by the firm in association with Italian or foreign private centers
PERFORMANCE	Turnover	Turnover for the year 2005
	Turnover Growth	Turnover of the firm compared to the previous year
EXPORT	Export	Percentage of revenue coming from selling abroad
IMPORTS	Imports	=1 if the firm imports raw material; intermediate goods; services; finished products

Table 4: Correlations between the some variables (\* significant at 5% critical level)

	Sales to FIAT	Turin District Dummy	Employm. Density	Firms' Density	Export	Pc GDP	Import	Turnover	Employm.	Turnover Growth	Research
Sales to FIAT	1										
Turin District Dummy	0.214*	1									
Employment Density	0.149*	0.699*	1								
Firms' Density	0.093*	0.688*	0.919*	1							
Export	-0.191*	0.016	0.069	0.098*	1						
Pc GDP	-0.104*	0.134*	0.303*	0.416*	0.151*	1					
Import	0.067	-0.027	-0.008	-0.014	0.260*	0.061	1				
Turnover	0.231*	0.040	0.080*	0.044	0.252*	0.005	0.333*	1			
Employment	0.174*	0.020	0.04	-0.003	0.258*	-0.048	0.289*	0.746*	1		
Turnover Growth	0.014	0.001	0.014	-0.003	0.126*	0.042	0.071*	0.106*	0.03	1	
Research	-0.034	-0.036	-0.042	-0.026	0.171*	-0.002	0.096*	0.075*	0.111*	0.008	1

Table 5: Internationalization, agglomeration and relations with FIAT: marginal effects for the logit model

<b>Internationalization</b>	(1)	(2)	(3)
<b>Turin District Dummy</b>	0.162*** (0.039)		
<b>Employment Density</b>		0.037*** (0.012)	
<b>Firms' Density</b>			0.068*** (0.019)
<b>Sales to FIAT Auto</b>	-0.004*** (0.001)	-0.004*** (0.001)	-0.004*** (0.001)
<b>Per capita GDP</b>	0.299** (0.121)	0.267** (0.125)	0.181 (0.133)
<b>Imports</b>	0.192*** (0.041)	0.190*** (0.041)	0.192*** (0.041)
<b>Turnover</b>	0.002 (0.002)	0.002 (0.002)	0.002 (0.002)
<b>Employment</b>	0.001** (0.000)	0.001** (0.000)	0.001** (0.000)
<b>Turnover Growth</b>	0.004** (0.002)	0.004** (0.002)	0.004** (0.002)
<b>Innovative products</b>	-0.100 (0.066)	-0.091 (0.067)	-0.092 (0.067)
<b>Mature products</b>	-0.071 (0.057)	-0.071 (0.057)	-0.073 (0.057)
<b>Low auto market</b>	-0.097 (0.092)	-0.095 (0.091)	-0.089 (0.091)
<b>Top auto market</b>	0.043 (0.059)	0.021 (0.058)	0.031 (0.058)
<b>Specialists</b>	0.155*** (0.051)	0.142*** (0.051)	0.149*** (0.051)
<b>Modules-systems</b>	0.135 (0.120)	0.123 (0.123)	0.126 (0.122)
<b>Engineering-design</b>	0.009 (0.063)	0.008 (0.064)	0.009 (0.064)
<b>Subsidiary</b>	-0.115 (0.119)	-0.137 (0.119)	-0.132 (0.120)
<b>Independent</b>	-0.049 (0.100)	-0.052 (0.099)	-0.050 (0.100)
<b>Research</b>	0.027*** (0.007)	0.026*** (0.007)	0.026*** (0.007)
<b>University Research Centres</b>	0.043 (0.127)	0.033 (0.125)	0.026 (0.127)
<b>Public Research Centres</b>	0.251*** (0.086)	0.254*** (0.085)	0.251*** (0.087)
<b>Private Research Centres</b>	-0.000 (0.119)	-0.004 (0.116)	0.007 (0.118)
<b>Observations</b>	737	737	737
<b>Pseudo R<sup>2</sup></b>	0.190	0.190	0.190

Standard errors in parentheses - \*\*\* p&lt;0.01, \*\* p&lt;0.05, \* p&lt;0.1



