Industrial districts, district effect and firm size. The Italian evidence.

Marco Cucculelli e Dimitri Storai

1. Introduction

Industrial districts (IDs) are one of the pillars of Italian manufacturing industry and one of its distinctive features. Over recent decades, industrial districts have undergone major transformations that have changed their characteristics, sometimes very significantly. One of the main changes has been the relocation of market power between districtual firms of different sizes, a process that has led to the emergence of medium-sized firms. Today, these firms are proving able to operate successfully on the global market because they are the best at managing size-dependent processes and routines within the districtual ecosystem. Nevertheless, their presence gives rise to a number of questions: (i) the type of relation that they establish with the socio-economic system in which they are located, and whether or not they can be considered 'embedded' in the local system; (ii) the type of effect that their presence may exert on the future evolution of the "Marshallian" industrial district model; (iii) whether the successful performance of these firms is a permanent feature of a new setting of industrial districts, or is just a transient characteristic of the reorganisation process of the industrial structure spurred by the external competitive pressure.

This paper aims at contributing to the debate on the transformations taking place in the Italian industrial districts by studying the changing influence of a company's districtual affiliation on its performance. In detail, after estimating the overall IDs influence observed in the past decade in a large sample of Italian manufacturing firms, the paper sheds some light on two issues connected to the IDs transformations: first, the role of size in explaining the districtual influence on individual firms' performances; second, the role of sectoral specialization in understanding the evolution of the district influence on firm performance. As most Italian IDs are focussed on traditional sectors, the paper provides evidence with which to discuss the issue of the renewal and reorganisation of mature industries driven by the increasing intensity of global competition.

Since the early 1990s, a strand of research has been carried forward by Italian scholars to verify the existence and the importance of the 'district effect' i.e. of the (positive) contribution to the firm's performance due to its being located in an industrial district. The first empirical evidence has mainly confirmed the presence of this effect, but only for the period between the 1990s and early 2000s. No other studies have been conducted during the past decade, a period in which the intensity of global competition has fostered significant changes and transformations in the productive systems of advanced economies. This is where the paper intends to make a contribution in addition to the analysis of the above-mentioned issue concerning the impact of the interplay among size, industrial specialization and district affiliation on firm performance.

The empirical analysis was run on a large dataset of 69,545 Italian manufacturing firms for the period 2004-2013. The dataset – that covered almost 90% of the universe of Italian firms with more than 20 employees – was unique in nature because it was built by combining firm-level financial data from Amadeus – Bureau van Dijk with information provided by the Italian Institute of Statistics (ISTAT) on the districtual affiliation of the company. The match was made by individual firm with each of the 141 industrial districts identified by ISTAT on 2011 Census data.

To preview the empirical findings, the estimated results show the absence of a generalized positive district effect on firm performance, and its fading over time in the period of analysis. However, the breakdown of the sample by size classes shows that the overall declining effect actually is the result of a balance between significant positive effects in medium-sized firms and negative (or null) effects for smaller-sized ones. This evidence raises the issue of the rebalancing of market power between size classes within districtual areas that results from the changes in the competitive environment driven by the intensity of global competition in mature industries. More generally, the positive contribution of districtual affiliation to firm performance does not depend uniquely on the company being and operating in a district; it also depends on the way in which districtual assets interact with firm assets in terms of resources and capabilities. An additional feature that emerges from the empirical analysis concerns the evidence on the evolution over time of the interaction between firm size and districtual assets. Empirical estimates by district age show that the leading role of medium-sized firms is intense in younger districts, whereas in older districts the benefits from districtual affiliation are widely spread across all size classes. This evidence opens to a complementary explanation of the emergence of medium-size firms as those business entities able to react more quickly and effectively to the changes of the competitive environment. Because of their inherent characteristics, these firms are able to take the lead of the reorganisation process that progressively benefits other size classes along the districtual value net. Finally, these results are strictly dependent on the company operating in the sector of specialisation of the district. For companies localised in IDs, but operating in different industries, there is no evidence of districtual influence on performance.

In sum, a new business system is developing where positive economies - external to the company but internal to the district, i.e. the Marshallian districts - are progressively internalized in leading companies embedded in the districtual system. This evidence has significant implications for the competitiveness of the districtual structure, its sustainability over time and the reproducibility of the mechanisms that have guaranteed the districtual success in the past.

The paper is organized as follows. Section 2 briefly summarizes the relevant literature, introduces the research questions and testable hypotheses. Section 3 presents the dataset and the empirical evidence. Section 4 summarizes the implications of the estimated results, and Section 5 concludes.

2. Theoretical framework

2.1 Italian Marshallian industrial districts, medium-sized firms and the challenges for model reproducibility

Industrial districts are one of the distinctive features of Italian manufacturing. They were one of the driving forces of Italian economic development after the Second World War (Amatori et al. 2013; Becattini and Coltorti 2004; Brusco and Paba 1997) and still today they play a key role in national manufacturing and more broadly in the national economy. In 2011, according to the industry and service Census, about 1/4 of local units and about 1/3 of manufacturing local units were located in industrial districts. Employed In these local units were about 1/4 of national employees and 1/3 of national manufacturing employees respectively (ISTAT 2015a). Moreover, the majority of these districts are specialized in traditional (mature) industrial sectors.

The conceptualization of Italian industrial district model – with the re-discovery and re-interpretation of the original concept first introduced by Alfred Marshall (1919; 1920) – took its first steps during the 1970s (Becattini 1975; 1978; 1979). It then developed in the following years thanks to the seminal contributions of scholars such as Becattini, Brusco and Fuà, and it was completed during the 1990s (Becattini 1990; Brusco 1989; Dei Ottati 1995; Fuà 1980; Fuà and Zacchia 1983; Sforzi 1987; Tani 1987).

Becattini defined an industrial district "as a socio-territorial entity which is characterized by the active presence of both a community of people and a population of firms in one naturally and historically bounded area. In the district, unlike in other environments, such as manufacturing towns, community and firms tend to merge" (Becattini 1990, p. 38). The key feature of the Italian industrial district model is therefore its multi-dimensionality: the model transcends the purely economic dimension and extends to the territorial and social dimensions as well (Becattini 1990; Becattini et al. 2009).

The social dimension and its interaction with economic processes represent the distinctive features of the Italian industrial district model, distinguishing it from different forms of industrial districts and from other organizational models of co-localized firms (Arikan and Schilling 2011; Markusen 1996). Italian industrial districts are often referred to as 'Marshallian industrial districts', and hereinafter this expression will be adopted.

The relations between the local production structure and the community of people living in the same territory are the source of the specific 'Marshallian district processes' that, in turn, give rise to distinctive 'Marshallian district economies' (Dei Ottati 1995; Dei Ottati 2006). These economies are similar to, but not identical with, the agglomeration economies that can be found in other contexts (Jacobs 1969, Krugman 1991, Marshall 1920, Parr 2002, Rosenthal and Strange 2003). [1]

Among other factors, crucial sources of Marshallian district competitiveness are trust among local actors, the sense of belonging to the local community, and the sharing of common values and implicit rules. These factors sustain the cooperation among firms operating in the 'communitarian market' (Dei Ottati 1995) which in turn allows a reduction of transaction costs

[1] An analysis of the complementary/substitute role of Jacobian economies in the performance of districtual firms is provided in Appendix B of the paper.

and underpins the competitiveness of local firms in terms of both cost reduction and innovative capacity.

The proper functioning of most of processes characterizing the Marshallian industrial district model and regulating the reproduction of districts themselves over time (Dei Ottati 2017) originate, therefore, from appropriate socio-economic dynamics. Conversely, the alterations in socio-economic dynamics internal to the district impact negatively on district processes, undermining the district's competitiveness (Dei Ottati 2009).

Since the 1990s, and increasingly with the new millennium, Italian industrial districts have been subject to large changes in internal and external environments primarily ascribable to the global reorganization of production processes (Dei Ottati 2017) and to the related birth and rise of the so-called 'global value chains' (Gereffi et al. 2005, Gereffi and Fernandez-Stark 2016). Two of the changes that have deeply affected Italian industrial districts are the entry on global markets and the increasing importance of new competitors – especially positioned in the lower segments of the markets – and the increasing market power exerted by distribution chains – especially for products intended for final consumers (Hamilton et al. 2011).

To cope with such major changes, Italian industrial districts have adopted new competitive strategies (Dei Ottati 2010, Foresti et al. 2014, Solinas 2006). Although each industrial district has reacted differently to environmental changes, some strategies that have been largely adopted and proved successful can be identified. Principal among them are product upgrading (Barbieri et al. 2009), the renewal of business models, with increasing importance of functions located upstream and downstream of transformation processes (Guelpa and Micelli 2007), the increase in investments in intangible assets and the development of new business models (Cucculelli and Bettinelli 2015), the reshaping of outsourcing networks, and participation in global value chains (Corò and Volpe 2006, De Marchi, Di Maria et al. 2018). Through the adoption of such competitive strategies, some industrial districts have been able to maintain or recover their competitiveness while others are experiencing difficulties often resulting in reduction of local firms and employment (De Marchi, Gereffi et al. 2018)

As a result of the adoption of these new competitive strategies, which have often proved to be very effective in maintaining or recovering local competitiveness, Italian industrial districts have, at least partially, modified their own features (Belussi and De Propris 2014, Dei Ottati 2010; Rabellotti et al. 2009;). Some scholars refer to them as 'new industrial districts' (Bellandi and Caloffi 2014, Bellandi and De Propris 2015).

One of the main phenomena taking place in Italian industrial districts in recent decades is the increasing role played by medium-sized final firms[2] (Coltorti 2009), which have proved able to compete successfully in new contexts. The sources of these firms' competitiveness are varied: ability to mobilize relevant internal resources in terms of knowledge, entrepreneurial culture, finance, organization skills; to develop intangible resources such as brands; to manage global value chains; and to interact effectively with their own market and with the distribution

[2] Industrial district firms can be distinguished between final and phase firms. Phase firms are subcontractors specialized in one or few phases of transformation processes. They produce to orders received from final firms and therefore do not have direct contacts with the final market. Final firms are specialized in design, coordinating the network of subcontractors, and managing the relations with customers. Most of them do not undertake any transformation process internally.

system (Accetturo et. Al. 2013, Giuliani and Rabellotti 2018, Guelpa and Micelli 2007, Markusen 1996).

Medium-sized firms are today considered one of the most dynamic components of Italian manufacturing (Conti and Modiano 2012). Regarding the relation between them and the areas in which they were born and in which they operate, it is widely recognized that these firms maintain a strong interaction with the local economic and social system (Coltorti 2009, Coltorti et al. 2012) and derive their competitiveness from local 'industrial atmosphere' and from economies external to the firms but internal to the system to which they belong (Coltorti 2017). Nevertheless, some authors highlight that some of these firms 'exit the district network completely' (De Marchi and Grandinetti 2014 p. 80) losing, in doing so, their feature of rootedness (Becattini 2000b; Coltorti 2006).

The long-term effects of the increasing role played by these firms on the Marshallian district model, and in particular on the district processes underpinning the competitiveness and the reproduction of local systems themselves, are still hard to evaluate. Medium-sized firms indubitably represent a source of renewal of local production systems, but the question is whether their presence is compatible with the Marshallian district model – even if revisited – or whether it has to be considered as one of the phenomena contributing to its collapse (De Marchi and Grandinetti 2014).

To answer this question, it is crucial to consider that both a systemic profile and the existence of systemic actions are essential elements whose presence is not secondary for the identification of a local system as a Marshallian industrial district. To deal with environmental changes, each actor can (and must) react by modifying its strategies, its behaviour and how it interacts with other actors located in the district and outside it. Nevertheless, if the choices of each actor are made with a strictly individual approach, without taking into account their potential impact on the local system and its reproducibility, a basic component of the Marshallian district model is being challenged. In this regard, according to Dei Ottati, much will depend on the behaviour of successful district firms. They can, in fact, operate by sustaining cooperation among enterprises, with a positive effect on the local system, or they can act in a predatory way with severe effects on the district's reproducibility (Dei Ottati 2017).

2.2 The district effect

By the phrase 'district effect' is meant the (positive) contribution to the firm's performance due to the location of the firm in an industrial district. The sources of the district effect are the above-mentioned district economies: economies external to the single firm, but internal to the local system, that are available to firms located in a district's territory and that, conversely, are not available for firms located outside it (Becattini and Musotti 2003; Dei Ottati 2006).

Signorini (1994) carried out the first research aimed at quantifying the district effect. Using balance sheet data, Signorini compared the performance of woolen textile firms operating in Prato (probably the archetype of the Italian industrial district), Biella and other territories in the 1980s. Empirical evidence showed that district localization exerted a positive effect on firm profitability.

After Signorini's paper, a wide range of studies investigated the impact of district location in terms of firm profitability (Fabiani et al. 2000), firm productivity (Becchetti et al. 2007; Cainelli and De Liso 2005), and firm export orientation (Becchetti and Rossi 2000; Becchetti et al. 2007; Bronzini 2000; Bugamelli and Infante 2005; Gola and Mori 2000). A wide and systematic analysis on this topic has been carried out by the Bank of Italy (Signorini 2000).

While these first studies found a significant and positive district effect, according to more recent ones the district effect has greatly diminished if not vanished (Intesa San Paolo 2009; Iuzzolino and Menon 2011). In a recent contribution, Di Giacinto, Gomellini, Micucci and Pagnini (2014) analyzed the impact of both urban and district location on a sample of manufacturing firms operating in Italy between 1995 and 2006. According to their results, in terms of productivity, urban and district firms outperform firms located in other territories. Nevertheless, the productivity premium for urban firms is three to five times greater than for district firms. Furthermore, while the premium for urban firms remained stable over time, the premium for district firms tended to decline.

These studies seem to support the hypothesis that district economies have been diminishing if not vanishing in recent decades. However, some recent contributions on the role of agglomeration in performance have shown that location has a very different influence on performance according to individual firm characteristics. In a sense, the different beneficial effect of the location is significantly moderated by the internal characteristics of the individual company or, more generally, economies and diseconomies of agglomeration may be dependent on specific and individual characteristics of the company, such as its size or sectoral specialisation (Knoben et al., 2015; Arikan and Schilling, 2011).

To sum up, the present paper aims at answering the following questions:

1) Does there still exist a district effect on Italian manufacturing firms' performance?

2) Does district localization exert differentiated effects on various firm categories and, in particular, on firms belonging to different size classes?

3) Is there any effect connected to the nature and type of sectoral specialization, i.e. mature & traditional sectors?

4) What are the implications for the future evolution of the Marshallian industrial district model?

3. Empirical analysis

3.1 Sample and data

The analysis was carried out using a dataset obtained through the merger of two different sources: (i) the AIDA – Bureau Van Dijk[3] dataset (for financial information at firm level) and (ii)

[3] AIDA – Bureau van Dijk is an authoritative and reliable source of information on Italian companies. AIDA draws information from official data recorded at the Italian Registry of Companies and from

the identification of Italian Local Labor Systems (LLSs) and industrial districts (IDs) realized by ISTAT - the Italian Institute of Statistics, using data from the 2011 National Census of the population and the 2011 National Census of Economic Activities.

The empirical analysis was conducted on a sample of 69,545 Italian manufacturing firms in the period 2004-2013. Firms included in the study represented a very large share of the universe of Italian manufacturing industry, and an even larger share of Italian manufacturing firms that are required to deposit their financial statements. When split by firm size, the incidence of the sample increased with size (Table A.1) and reached almost 100% for higher size classes, in particular for firms with compulsory financial statement deposit. If the obligation to deposit the financial statement signals a non-marginal organizational structure of the company, we are confident that this sample was well suited for the analysis of the overall Italian manufacturing industry. In any case, we will remain cautious with the results regarding the size class with fewer than 20 employees.

To carry out analysis by firm size, sample firms were allocated to one of the following size classes: fewer than 20 employees, 20-49 employees, 50-99 employees, 100-249 employees, 250-999 employees. Because of our focus on district firms, we did not include in the sample companies whose number of employees was equal to or higher than 1,000.

Information related to firm location resulting from AIDA dataset was matched with industrial districts identification carried out by ISTAT (ISTAT 2015a, 2015b)[4]. According to this classification, 41.5% of the firms in the sample were considered 'districtual firms', that is, firms located in a territory identified as an industrial district, whereas we classified the remaining 58.5% as 'non-districtual firms'.

In the identification process of IDs, ISTAT adopted an *ad hoc* definition of manufacturing activity (see Table A.2) and similarly, an *ad hoc* classification of manufacturing activities in 'industrial typologies' (see Table A.3). The same definition of manufacturing activity - and the same internal classification - has been adopted here to make the sample identification consistent with ISTAT analysis.

We measured firm performance by profitability using the Return of Sales (ROS) index. To avoid sector, year and size class biases, a variable was created as the difference between a firm's ROS in a given year (time t) and the median ROS computed for firms operating in the same 'industrial typology' and belonging to the same size class in the same year (Adjusted ROS). This variable can be considered an indicator of firm competitive advantage (Villalonga, 2004).

Table 1 reports the distribution of sample firms by industrial typology and districtual affiliation. Data confirm the important role played by 'Made in Italy' products and by Mechanical industry

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financial statements filed with the Italian Chambers of Commerce. Companies furnish data on a compulsory basis. The dataset that we used provides information on more than 500,000 limited share and limited liability Italian companies (Spa and Srl). The information provided includes company profiles, company location, credit reports and financial information drawn from financial statements. Each company's financial statement is updated annually.

[4] ISTAT elaborated a multiple-stage algorithm to identify IDs. In the first step, the algorithm divided the national territory into Local Labor Systems on the basis of census information about daily commuting movements of the population. In the second step, IDs were identified as LLSs characterized by a high presence of small and medium-sized firms and a high degree of industry specialization.

in Italian manufacturing. Furthermore, a significant share of firms specialized in 'Made in Italy' products - especially in 'Textiles and apparel', 'Leather and leather products' and 'Jewellery and musical instruments' – are located in industrial districts. Finally, a large share of industrial district firms operating in the latter industrial typologies are located in industrial districts with the same specializations.

Table 2 shows the mean ROS of sample firms by size and district location for the years 2004 and 2013. In 2004 non-district firms belonging to the 0-19 and 20-49 size classes outperformed district firms belonging to the same size classes while, as for the other size classes, district firms outperformed non-district firms. In 2013 district firms outperformed non-district firms in all size classes except the 50-99 one.

3.2 The empirical model

To test the effect of location, size, and specialization on firm-specific profitability, we estimated regression models both on the overall sample and on subsamples split by size class. The general model that we adopted was the following:

$$Y_{i,t} = \alpha + \beta_1 D_i + \beta_2 Age_{it} + \beta_3 Age2_{it} + \beta_4 NNW_{it} + \beta_5 TotAss_{it} + \beta_6 Controls + \varepsilon_{i,t} \quad (1)$$

where $Y_{i,t}$ is the industry-adjusted ROS, D_i is a dummy variable indicating if the company is located in an industrial district, and β is the parameter of interest. Age_{it} and $Age2_{it}$ are the age of the firm (in decades) and the squared value at time t respectively. NNW_{it} is a dummy variable equal to one if the firm has a negative net worth. $TotAss_{it}$ is the natural logarithm of firm total assets at time t. *Controls* include industrial typology, NUTS3 geographical region, size class, year, and the following interactions: year-industrial typology, year-size class, and size class-industrial typology.

To test for the effect of specialization, firms located in industrial districts were divided into two different groups: i) firms operating in the industrial typology in which the industrial district was specialized (for instance, a textiles firm operating in a textiles district); and ii) firms operating in an industrial typology different from the district specialization (for instance, a textile firm operating in a mechanical district). Two different dummies were created to test these different effects: 'IDs (Specialization industrial typology)' and 'IDs (Other industrial typology)'. The model that we ran to test the specialization effect was the following:

$$Y_{i,t} = \alpha + \beta_1 Dspec_i + \beta_2 Dother_i + \beta_3 Age_{it} + \beta_4 Age2_{it} + \beta_5 NNW_{it} + \beta_6 TotAss_{it} + \beta_7 Controls + \varepsilon_{i,t} \quad (2)$$

When models were estimated for a single year, we dropped the control 'year' and its interactions. Similarly, in models referred to a single size-class, the control for 'size class' and its interactions were dropped. In all estimations, standard errors were robust to heteroskedasticity. In pooled models, standard errors were clustered at firm level.

As a robustness check, we first ran a regression using adjusted ROA as dependent variable to assess the influence of a different performance measure. Second, we ran a random effect panel model to account for the large number of firms included in the panel. Finally, we

controlled for the index of industrial production (two-digit) to account for demand-driven changes in performance not accounted by the supply side of the model. In all robustness checks, estimated results were not dissimilar to those presented in the main analysis.

3.3 Results

Table 3 reports the results of the estimates of Equation (1). Apparently, the model rejects the hypothesis of the presence of a "district effect" on firm performance: the estimated coefficients are generally small – and mostly negative – in all the years, and never statistically significant. In a sense, this evidence confirms the absence of – or a significant decline in – the "district effect" on individual firm performance in the last decade. Besides, the evidence is less pronounced in the years after the 2008 crisis, probably because of the positive impact on profitability of the safety net that the districtual organization provided in response to the growing global competition. Also, older firms performed better in the years before the crisis, probably because of established routines that provided a comparative advantage during good times. Conversely, after the crisis, size became the variable mostly helping performance, probably because of its positive impact on the ability to mobilise relevant resources and to manage the network of suppliers.

When a breakdown by size class is introduced, estimated results provide other significant findings. Whereas estimated results for the overall sample - Column 1 of Table 4 - confirm the non-significant influence of the district affiliation on firm performance, the district effect seems to work across size classes, but in very different directions. In particular, the influence of the districtual affiliation is negative for the size class between 20 and 49 employees (b=-0.162*, Column 3), and it is positive (and statistically significant) for the size class between 100 and 249, i.e. for medium-sized firms (b=0.455**, Column 5).

Medium-sized firms emerge as local players best able to exploit their embeddedness in the districtual system, and to leverage districtual assets as a primary source of their competitiveness (Becattini 2000b). They are able to combine the districtual economies with internal resources and capabilities, like the management of brands, distribution channels and supplier networks. They are also ready to position themselves within global value chains, as well as to exploit the local productive capacity generated by the mass of districtual suppliers.

This evidence also implies that the more the districtual advantage that these firms gain from being embedded in the local system, the less likely they are to move their activity out of the district to areas with lower production costs or wages. If confirmed, this implication can impact positively on industrial districts, not just for the maintenance of employment, but also for the renewal ability that a larger group of competitive medium-sized firms can bring to the local area (Cucculelli et al. 2016).

When it comes to the size class between 20 and 49 employees, location in a districtual area actually reduces profitability, in comparison to firms operating outside the district. These districtual firms, highly specialized in single productive phases and mostly – if not solely – selling to local buyers, experienced a pronounced decline in profitability, also because of the intense selection process of upstream firms made by medium-sized firms on their suppliers network. Moreover, the economic resilience induced by being the only source of wealth for

many families behind these firms explains why many of these businesses are still active despite their poor financial performance (the firm as a "lifetime project" as in Becattini, 2000a, p. 18).

More generally, even if districtual firms in the size class 20 – 49 are likely to benefit from some types of districtual advantage, the balance on their overall performance is negative because districtual benefits are usually traded off with high specific costs – the higher cost of building – or low final prices – due to the excess supply.

In the past decade, other factors have negatively affected the performance of small-sized firms in IDs. Firstly, the excess of productive capacity has been exacerbated by the intensity of competition driven by the bullwhip effect. Secondly, medium-sized firms have extended the scope of their value networks by including suppliers located in other countries, for cost reasons or for market purposes. Thirdly, the opening of global value chains in traditional sectors has altered the balance of substitutability between districtual and non-districtual suppliers. Finally, pure cost considerations have driven out of the market even old and well-positioned suppliers able to produce a significant and regular flow of technological and market innovations.

The breakdown of IDs by type of specialisation provides further evidence on the role of districtual affiliation on firm performance. In Table 5, the overall district effect is split between districtual firms operating in the industrial typology in which the district is specialized (IDs specialisation industrial typology) and districtual firms operating in a different industrial typology (ID other industrial typology), but located in the district. Starting from this second group of firms, the connection between districtual location and performance is rather weak, if existent at all: this is evident for both the overall sample and for all size groups considered in the analysis. Estimated coefficients are never statistically significant and are very small in size except for the size class 100-249. Therefore, the overall district effect that we have observed in the first part of the analysis (Table 3 and 4) mainly derives from the group of firms operating in the districtual specialisation. For these firms, the district effect is generally negative, either when it is computed for the overall sample, or in the case of the smaller size class. The only positive result is observed in the case of districtual firms in the size class 100-249 operating in the district industrial typology of specialisation.

This evidence makes it possible to qualify the previous results by strongly connecting the existence of a (negative) positive district effect only on firms in the (20-49) 100-249 size class and operating in the industrial typology in which the district is specialized. For firms with similar size but operating in different industrial typologies, the districtual location does not have any significant impact on performance.[5]

3.4 District evolution and the size/performance relationship

[5] In comparison with the model with no distinction among industrial typology of specialisation, the evidence in Table 5 shows a negative district effect even for smaller firms included in the size class 0-19. However, because of the size of the sample and the large heterogeneity observed in this size class, we suggest to consider this result with caution.

Previous evidence shows that medium-sized firms mainly benefit from district location because they are able to leverage high-level assets and to manage complex market relationships. By contrast, micro and small firms appear in the weakest position of the firm size distribution, a fact that generates concerns about the long-term sustainability of the district model as analysed in the following section.

To frame these results in a wider picture, we have explored the influence of the district age (or maturity) on the size/performance relationship. The basic idea behind this argument is that the presence of an unbalanced district effect across firm size classes can be the result of a process of reorganisation of the district that selectively affects firms of different size. If the timing of the reaction of districtual firms differs because of asymmetrical exposure to external competitive pressures, or because of the different ability to react to the external changes, a cross sectional analysis of district performance can provide ambiguous results. Indeed, firms largely exposed to international markets and with a larger set of relevant assets, like medium-sized firms, can develop routines to face competition more promptly than other smaller districtual firms, mostly linked to major contractors and with a narrower set of resources. Consequently, younger districts – i.e. districts that have experienced lower or more recent competitive pressures – may be populated by firms with heterogeneous reaction abilities, whereas mature districts should show well-reacting firms spread across all the firm size classes.[6] If this process view is realistic, low performing size-classes do not indicate a generic inferior competitive ability, but only less reactive players who are expected to recover eventually. This makes the age-dependent districtual performance of different size classes a hypothesis worth being tested.

One of the most fruitful avenues for studying this issue relies on models of district life cycle (Trippl et al 2015; Valdaliso et al, 2013; Martin and Sunley, 2011; Jia et al, 2015). A large body of literature, with different methods and results, generally agrees that districts undergoing competitive pressures may react differently to similar external forces, thus ending up with different performances when observed in cross section. In line with this literature, we suppose that the intensity and the nature of the response can be related to the position of the district along its life cycle, because firms in mature districts have probably developed better routines to cope with external competition, whereas younger districts have to rely mainly on the guiding role of a few leading firms.

To frame this issue as a testable hypothesis, we divided sample firms by LLS of location and industrial typology of specialisation. We used sector-affiliated sample firms by district to compute the district age. Then, we clustered the distribution of district age in quartiles to contrast the influence of districtual affiliation on performance separately in young versus mature districts. Under the hypothesis of the existence of better and more robust competitive routines in mature districts, we expected a positive and generalised response across all firm size classes in older districts. By contrast, a non-generalized and selective response by size

[6] If the competitive reaction of the company is size-specific – because it depends on the extent and the size of market relations that the company is able to manage and on the resources set on which the company can rely - the district performance by size class can emerge as an indirect outcome of its evolutionary process. Thus, relatively poor (or good) performance by size class may only signal a slower (quicker) response time by firms - or firms by size classes - to external pressures, and not an inferior or superior competitive capability.

classes is expected in younger districts, where more reactive firms – i.e. medium-sized firms in our hypothesis – initially take the lead, and are eventually followed by less reactive firms.

Table 6 presents some descriptive statistics on the age distribution of Italian districts by industrial typology. Average district age varies from 17.6 to 27.0, with a significant standard deviation and a large interquartile range. Within industrial typologies, the distribution of district age is quite scattered, with a min-max difference of 27 years for the mechanical industry, up to 82 years for jewellery and musical instruments.

Table 7 – Panel A shows estimation results of Equation (1) by quartiles of district age. To save space, only coefficients of the district affiliation variable are reported.[7] The first column summarizes the overall district effect, whereas columns 2 to 6 display results by size class. The evidence shows that the negative district effect on firm performance is almost completely associated with the first (and in part the second) quartile of the distribution, i.e. with younger districts in each sector. This evidence is consistent with the findings from the general model: that is, medium-sized firms mainly drive the competitive reaction, whereas smaller firms lag behind. By contrast, and interestingly, the district effect is positive and spread across all the classes of the size distribution in the fourth quartile, i.e. in the cluster of older districts, where all size classes significantly benefit from a district effect. To sum up, when districtual firms are supposed to have heterogeneous reaction abilities to external competition, a districtual advantage is likely to spread across size classes, but only in mature districts. More generally, the benefits of districtual affiliation by size class change over time as districts age, with an involvement of more reactive firms at the beginning and a later engagement of less reactive ones.

Table 7 - Panel B presents the results of a robustness analysis run using the share of limited liability firms on total firms as a proxy for district age. As older firms are expected to adopt more formal company structures, this ratio can be used to proxy for the district maturity. Results reported in Table 7 - Panel B broadly confirm previous results, in particular the idea that differences in the performance by size class can be related to differences in the stage of the district evolution process.

4. Future prospects

Because of their size, medium-sized firms are able to shape the relations that they establish with most of their partners (Ozen et al. 2016). In particular, bigger size can be a source of market power that, if the firms decide to exert it, can impact on the profitability of the firms themselves and on the performance of their partners. In the Marshallian industrial districts, where the relations among local actors are characterized by the absence of significant and persistent asymmetries in market power, a similar phenomenon can alter some of the processes underpinning the local competitiveness and the reproducibility of the model itself. In this case, it is reasonable to assume that the organizational model tends to transform itself into something other than a Marshallian industrial district (Markusen 1996).

[7] Detailed full estimates are available from the authors.

The business model developed by medium-sized firms in industrial districts optimally mixes assets located in industrial districts and firm-specific resources that firms have been able to develop during the reorganization phase of the industry (Cucculelli and Bettinelli, 2016). This unique combination of external and internal resources is largely based on the ability of medium-sized firms to extract benefits from the local industrial structure, an aspect that is only permitted to them by their being "rooted" in the IDs. Moreover, their being strictly interconnected with the local system allows medium-sized firms to play a 'pivotal role' in the IDs, because they are the main contacts with the final destination markets and – at the same time – the biggest buyers for the districtual suppliers.

In the balancing of market power across the different size classes, the typical districtual firm – highly specialized and very small in size – appears to have lost competitive power in favor of larger firms, because of the asymmetry in the substitutability of the market relationships between upstream and downstream competitors. The difficulties faced by the large groups of districtual firms may end up in weaknesses for the entire districtual system in some cases. Firstly, the unequal (perceived and effective) division of wealth among firms participating in the districtual system can destroy the social network of relations based on trust, and on the sense of belonging to the community. In the long run, this process may alter the competition and cooperation mechanisms that have sustained the development of the districts, and increase the transaction costs that are the foundation of the districtual economies. Secondly, "the increase in size and the managerial approach of some firms may lead to a recovery of competitiveness in the local system, but such an outcome could, on the contrary, result in the overall decline of the local system as a district" (Dei Ottati, 2017). The outcome will depend on the behaviour of the enterprises that have succeeded in regaining competitiveness: if they contribute to a renewal of the districtual body of knowledge, then the effects will be positive both for the local economy and the local society. Conversely, if they adopt a predatory behaviour and fail to allow circulation of the knowledge that they possess, or exploit their position of power to the detriment of the smaller enterprises, renewal will be doomed to decline, despite the fact that individual firms may be prospering (Dei Ottati, 2017). Thirdly, low profit margins in the portion of the size distribution populated by smaller firms may reduce the incentives to create new firms, thus reducing the importance of the entrepreneurial attitude as the main factor for the renewal of the districtual economy. Furthermore, low profit margins may also impact on the ability of smaller firms to invest in and support innovation.

The prospect of a decline in the district organization and the resulting transformation of local system into a different – less localized – organizational model is not, however, inevitable. Local systems can regain competitiveness also remaining in the industrial district model framework, but adapted to the new contexts. Indeed, a complementary view supports the idea that the presence of an unbalanced district effect across firm size classes can be the result of the dynamic reorganisation process of the district when it faces external competition. The rationale behind this view relies on the heterogeneity in the reaction abilities of districtual firms, which, in turn, are due to an asymmetrical exposure to external pressures and to the different set of resources available to firms of different sizes. Firms more exposed to international markets – and that can rely on a larger set of relevant assets – are more likely to develop routines to face competition more promptly than smaller, or less exposed, firms. This makes the presence of heterogeneous reaction abilities a distinctive trait of younger districts, whereas older districts benefit from the existence of reactive firms across all the size classes. If

this view is realistic, the differential performance by size class could be a transient feature of the district evolution, and a positive note on the ability of the district to regenerate and compete.

5. Final remarks

This paper has sought to contribute to the recent debate on changes in IDs by studying the influence of the "district effect", i.e. the (positive) impact of the districtual affiliation of the company on its profitability. The analysis has been carried out at an aggregate level and also by considering the discriminating role of firm size.

When evaluated on the entire sample, empirical results have confirmed the absence of an overall "district effect" on the performance of Italian manufacturing firms operating in IDs. However, differences have been observed when size classes are considered. Specifically, the influence of districtual affiliation is positive for firms in the size class between 100 and 249 employees and negative for smaller size classes.

Because of their location in IDs, medium-sized firms have been probably able to exploit districtual assets by developing firm-specific competencies needed to compete in global markets. The availability of a large supply of innovative and reliable components producers has allowed medium-sized firms to concentrate their strategic focus, and financial resources, on size-dependent functions, such as brand management, supplier chain management and market innovation. They have progressively abandoned their old business models, largely based on assembly and commercialisation, and reoriented their market activity towards different strategic approaches aimed at producing higher value added (Cucculelli and Bettinelli, 2015). Their "rootedness" in local systems has also confirmed the feasibility of the option to maintain a significant part of the productive system in the district, thus providing firms in industrial countries with a new way to compete in traditional or mature sectors.

Conversely, the districtual affiliation has emerged as a negative component of profitability for districtual firms of small size, especially in the case of firms operating in the same sectoral specialisation of the district. These firms usually compete in single phases, are highly specialised in few stages of the productive process and have quite a few customers, in most cases located in the same district. For these firms, the positive influence of the district has been totally offset by the negative impact of districtual burdens connected to the increasing costs of production and establishment, together with an increasing competition (especially by competitors located in other countries) within their elective productive stages.

The empirical findings provide evidence to discuss the implications of the asymmetry among firm size in the appropriation of economic benefits within IDs, the long term sustainability of the districtual model, and its possible avenues of evolution.

If medium-sized firms have been an effective response to the adverse economic conditions, the difficulty encountered by small-sized firms generates risks for the competitiveness of the IDs and their survival over time. In this framework, and in addition to the usual changes in the external economic environment, a key role is played by the behaviour that the main economic actors will be able (and willing) to play.

Medium-sized firms may either decide to exploit the districtual base and avoid any investment in the local community, or on the contrary extend their "pivotal role" to the benefits of the district. In these two opposite cases, the impact of firms' behaviour on the sustainability of IDs' competitive conditions will be very different, and so will the IDs' economic prospects in the long run. In the absence of predatory practices by medium-sized firms, or in the positive case of a wise management of upstream/downstream supplier relationships, the competitiveness of the IDs may be maintained or even strengthened. Contrarily, if medium-sized firms will exploit the existing networks of suppliers until they survive, or change their business models to cope with the vanishing benefits of the districtual organisation, the potential impact on IDs competitiveness could prove negative. In both cases, a reaction is expected from smaller firms wanting to survive in the long run. If the decline in the number of upstream suppliers is massive, the surviving companies may have the option to reach a good standard of innovative capacity and bring the power balance back to the original setting. This is what we have observed in some IDs that have experienced a strong reorganisation process spurred by the growing market power of medium-sized firms. After the initial shakeout in upstream producers, surviving suppliers have begun an intense renewal process - mostly founded on innovation - that has enabled them to regain leadership in the value chain of the district. This intuition is backed by the evidence of a positive contribution of districtual affiliation spread across size classes only in mature districts, where a selection made by the firm's reaction ability is crucial for understanding the prospective evolutionary path of the districtual connections.

Finally, the role of public policy is crucial for assessing the status of the IDs' economic structure, the composition of market power among different players, and the overall ID innovation intensity. Close attention to these issues can help IDs to maintain a balanced approach between competition, cooperation and trust; factors that have allowed many IDs to become high-class organisational forms in terms of competitiveness and economic success.

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Table 1 - Sample distribution by industrial typology and districtual affiliation

	Number of firms	Share of firms*	Share of district firms*	Share of district firms *	
				Specialization industrial typology**	Others industrial typologies**
Textiles and Apparel	5,500	7.9 %	60.2 %	39.5%	20.6 %
Leather and leather products	2,816	4.1 %	67.6 %	46.6 %	20.9 %
Household goods	8,157	11.7 %	40.3 %	12.5 %	27.7 %
Jewellery and musical instruments	900	1.3 %	59.9 %	38.3 %	21.6 %
Food products	6,494	9.3 %	30.6 %	4.4 %	26.1 %
Machinery and equipment	30,040	43.2 %	40.1 %	20.3 %	19.7 %
Basic and fabricated metal products	1,413	2.1 %	45.2 %	2.6 %	42.5 %
Chemicals, rubber, and plastic products	6,824	9.8 %	38.5 %	3.3 %	35.2 %
Transport equipment	1,877	2.7 %	26.4 %	0.0 %	26.4 %
Paper products, publishing and printing	4,067	5.8 %	31.1 %	1.8 %	29.3 %
Others manufacturing industries	1,457	2.1 %	34.6 %	0.0 %	34.6 %
Total	**69,545**	**100%**	**41.1%**	**16.6 %**	**24.4 %**

* Shares are all calculated on the overall firm sample

** Columns split industrial districts firms into two subcategories: industrial district firms operating in the same industrial typology as the industrial district is specialized in (left column) and industrial district firms operating in different industrial typologies (right column)

Source: Authors elaboration on AIDA-BVD and ISTAT data

Table 2 – Mean ROS by size class and district location – 2004 and 2013

	2004		2013	
	District firms	**Non-district firms**	**District firms**	**Non-district firms**
0-19	4. 57 %	4.59 %	4.02 %	3.87 %
20-49	4.68 %	4.83 %	2.93 %	2.70 %
50-99	4.73 %	4.62 %	2.60 %	2.67 %
100-249	5.28 %	4.69 %	2.76 %	2.01 %
250-999	5.23 %	4.51 %	2.65 %	1.38 %

source: Authors elaboration on AIDA-BVD and ISTAT data

Table 3 – District effect – Estimation by year

	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
Constant	-0.206	0.039	1.021 ***	-0.658	-1.095 ***	-2.705 ***	-0.830 **	-0.748 **	-1.731 ***	-3.116 ***
IDs	-0.058	-0.085	-0.067	-0.069	-0.047	-0.021	0.046	-0.009	-0.041	0.000
Age	0.303 ***	0.282 ***	0.343 ***	0.548 ***	0.298 ***	-0.411 ***	0.003	0.093	-0.079	0.023
Age²	-0.043 ***	-0.041 ***	-0.045 ***	-0.072 ***	-0.051 ***	0.013	-0.023 ***	-0.030 ***	-0.024 ***	-0.036 ***
Negative Net Worth (dummy)	-10.332 ***	-10.392 ***	-10.258 ***	-10.629 ***	-11.427 ***	-11.826 ***	-11.186 ***	-12.852 ***	-14.651 ***	-15.079 ***
Total assets (ln)	0.026	-0.013	-0.125 ***	0.034	0.157 ***	0.489 ***	0.205 ***	0.149 ***	0.261 ***	0.451 ***
N	44,846	47,539	50,259	53,118	55,867	58,582	61,308	62,747	62,931	61,919
Adj. R^2	0.040	0.036	0.038	0.044	0.048	0.049	0.046	0.067	0.090	0.105

Each model includes controls for region, size class in terms of employees, industrial typology, and interaction between size class and industrial typology

Standard Error Estimation robust to heteroskedasticity

***; ** and * indicate statistical significance at 1 %, 5 % and 10 % level respectively

Table 4 – District effect – Pooled estimation by size class

	Overall sample	Size class (Employees)				
		0-19	**20-49**	**50-99**	**100-249**	**250 - 999**
Constant	-0.977 ***	-0.340	-1.695 ***	-5.696 ***	-7.681 ***	-7.232 **
IDs	-0.031	-0.024	-0.162 *	-0.017	0.455 **	-0.292
Age	0.116 ***	0.135 ***	0.036	0.232 *	0.697 ***	1.146 ***
Age²	-0.034 ***	-0.046 ***	-0.031 **	-0.036 **	-0.074 ***	-0.118 ***
Negative Net Worth (dummy)	-12.360 ***	-11.655 ***	-12.827 ***	-15.777 ***	-18.376 ***	-16.518 ***
Total assets (ln)	0.180 ***	0.081 ***	0.278 ***	0.462 ***	0.764 ***	0.703 ***
N	559,116	354,176	124,528	45,600	25,433	9,379
Adj. R^2	0.060	0.058	0.061	0.069	0.090	0.077

Each model includes controls for region, year, industrial typology, and interaction between year and industrial typology

Standard Error Estimation robust to heteroskedasticity and clustered at firm level

***; ** and * indicate statistical significance at 1 %, 5 % and 10 % level respectively

Table 5 – District and specialization effects – Pooled estimation by size class

	Overall sample	Size class (Employees)				
		0-19	20-49	50-99	100-249	250 - 999
Constant	-0.966 ***	-0.329	-1.683 ***	-5.699 ***	-7.674 ***	-7.203 **
IDs (Specialization industrial typology)	-0.102 *	-0.123 *	-0.270 ***	0.006	0.629 **	0.142
IDs (Others industrial typologies)	0.016	0.039	-0.089	-0.033	0.346	-0.610
Age	0.116 ***	0.134 ***	0.036	0.232 *	0.695 ***	1.150 ***
Age^2	-0.034 ***	-0.046 ***	-0.031 **	-0.036 **	-0.074 ***	-0.118 ***
Negative Net Worth (dummy)	-12.360 ***	-11.654 ***	-12.830 ***	-15.777 ***	-18.377 ***	-16.518 ***
Total assets (ln)	0.181 ***	0.082 ***	0.279 ***	0.462 ***	0.764 ***	0.697 ***
N	559,116	354,176	124,528	45,600	25,433	9,379
Adj. R^2	0.060	0.058	0.061	0.069	0.090	0.078

Each model includes controls for region, year, industrial typology, and interaction between year and industrial typology

Standard Error Estimation robust to heteroskedasticity and clustered at firm level

***; ** and * indicate statistical significance at 1 %, 5 % and 10 % level respectively

Table 6 – District age by industrial typology – Descriptive statistics

Districts by industrial typology	mean	sd	min	max	p25	p50	p75	skewness	kurtosis
Textiles and Apparel	20.8	5.8	2	46.5	17	19	27	0.224	2.571
Leather and leather	17.6	4.3	4.5	47	16	18	20	0.649	9.821
Household goods	21.3	4.7	6	45	19	21	24	0.643	4.977
Jewellery and musical ^^	22.0	6.0	1	83	22	23	24	1.355	24.178
Food products	24.3	7.5	6	52.5	20	24	28.5	0.376	4.224
Machinery and equipment	19.5	3.7	5	32	18	19	21	0.546	3.351
Basic and fabricated metal	27.0	7.0	2	50	22	27	32	-0.488	3.602
Chemicals, rubber, and	22.1	4.9	1	39	19	23	25.5	-0.443	3.807
Transport equipment	18.7	9.2	2	62	12.5	18	21.5	1.011	4.590
Paper products, publishing	23.0	5.8	2	53	20	23	26.5	0.213	5.802
Others manufacturing	20.5	7.0	2	68	17	20	24	0.848	9.016
Total	20.7	5.4	1	83	17.5	20	24	0.743	6.076

Source: Authors elaboration on AIDA-BVD and ISTAT data

Table 7 – Influence on performance of districtual affiliation – Estimates by quartile of district age, share of limited liability companies and size classes.

PANEL A – Quartiles of district age

	Total	0-19	20-49	50-99	100-249	250-999
I quartile	-0.107**	-0.188***	-0.169*	0.394**	0.753***	0.486
	(0.041)	(0.051)	(0.098)	(0.160)	(0.221)	(0.522)
II quartile	-0.166***	-0.251***	-0.378	0.344	0.173	0.852
	(0.045)	(0.071)	(0.259)	(0.268)	(0.182)	(0.593)
III quartile	0.024	0.124	0.002	-0.190	0.247	-0.717
	(0.065)	(0.082)	(0.140)	(0.255)	(0.288)	(0.558)
IV quartile	0.220***	0.360***	0.152*	0.492**	0.084*	-0.607
	(0.077)	(0.098)	(0.069)	(0.201)	(0.042)	(0.620)

PANEL B – Quartiles of district share of limited liability companies (SPA & SRL) on total firms by district

Quartiles of	Total	0-19	20-49	50-99	100-249	250-999
I quartile	-0.324***	-0.328**	-0.418*	0.236*	0.746**	-0.400
	(0.116)	(0.145)	(0.232)	(0.144)	(0.290)	(1.296)
II quartile	-0.0705	-0.2301*	-0.0729	0.421	0.296	1.728**
	(0.108)	(0.120)	(0.230)	(0.371)	(0.515)	(0.852)
III quartile	-0.0800	0.0196	-0.118	-0.0856	0.763	-0.272
	(0.101)	(0.140)	(0.218)	(0.368)	(0.522)	(0.861)
IV quartile	0.0994**	0.125*	0.031**	-0.0081	0.650**	0.133
	(0.043)	(0.071)	(0.014)	(0.236)	(0.295)	(0.606)

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Table A.1 - Sample coverage by size class – Comparison with the 2011 National Census of Economic Activities

	0-19	20-49	50-99	100-249	250-999	0-999
Percentage share of sample on total firms	10.1%	64.9%	84.4%	86.6%	94.0%	14.4%
Percentage share of sample on firms with compulsory account deposit	38.7%	73.8%	86.7%	87.6%	94.4%	46.9%

Source: Authors elaboration on AIDA-BVD and ISTAT data

Table A.2 – ISTAT – 'Manufacturing activity' definition, in terms of ATECO 2007 codes, adopted to identify IDs

	ATECO 2007 codes[8]
Manufacturing activities	10 - 33, 383, 581, 59201, 59202, 95120, 95220, 95240, 95290

Source: Authors elaboration on ISTAT (2015b)

[8] ATECO 2007 is the classification of economic activities used by ISTAT. It is the translation of the NACE rev. 2 classification.

Table A.3 – ISTAT – 'Industrial typologies' definition, in terms of ATECO 2007 codes, adopted to identify IDS

Industrial typology	ATECO 2007 codes
Textiles and Apparel	13, 14
Leather and leather products	15
Household goods	16, 23, 31, 3291, 32994, 9524, 9529
Jewellery and musical instruments	264, 3211,3212, 322 - 324
Food products	10, 11, 12
Machinery and equipment	182, 2453, 2454, 25, 261 - 263, 265 - 267, 2711, 2712, 2720, 2731, 2732, 274, 275, 279, 28, 29310, 304, 325, 3311 - 3314, 332, 9512, 9522
Basic and fabricated metal products	241 - 243, 2441 - 2445, 2451, 2452
Chemicals, rubber, and plastic products	19, 201 - 204, 2052 - 2060, 21, 22, 2446, 268, 2733, 32991
Transport equipment	291, 292, 29320, 301 - 303, 30911, 30912, 30921 - 30923, 30990, 3315 - 3317, 38312
Paper products, publishing and printing	17, 181, 581, 59201, 59202
Others manufacturing industries	20510, 30924, 3213, 32992, 32993, 32999, 3319, 38311, 3832

Source: Authors elaboration on ISTAT (2015b)

Appendix B – The influence of productive diversification on performance

The literature on districts and agglomeration externalities remains inconclusive as to whether specialized or diversified local production structures favour local competitiveness (van der Panne, 2004**)**. Dating back to Marshall's (1890) 'Industrial District-argument', the availability of shared assets, such as the provision of specific goods and services by specialized suppliers, the creation of a local labour market pool, and knowledge externalities may positively affect the local firms' ability to be competitive. By contrast, Jacobs (1969) argues that knowledge may spill over between complementary rather than similar industries as ideas developed by one industry can be applied in other industries, and the exchange of complementary knowledge across diverse firms facilitates search and experimentation. To test this trade-off in our setting, we borrow the basic framework developed by van der Panne (2004) and compute an index of production structure that summarizes the degree of productive diversification (PD) at district level. Following van der Panne (2004) and Paci and Usai (1999), Jacobian diversification externalities can be measured by the extent to which the local production structure in a district *j* is diversified according to the production structure diversity index PD:

$$PD = \left[{}^{2}/_{(n_j - 1)} \sum_i E_j^{*} \sum_{i=1}^{n-1} \square \sum_i E_j \right]$$

where *n* is the number of local industries, and *E* is employment in industry *i*, ordered ascendingly by size. Larger values correspond to more diversified district production structures.

Table B.1 reports some descriptive statistics of the characteristics of Italian districts by industrial typology and intensity of productive diversification. The low and high PD columns include respectively the share of districts that are most concentrated (low PD index) or diversified (high PD index). Among the first group, districts in major traditional sectors like Leather and Leather products, Textiles and Apparel together with Jewellery, are those with the lowest productive diversification. By contrast, districts in the Food industry, together with Transportation and Household goods are the less concentrated districts.

Table B.1 – Share of districts by productive diversification (PD) and industrial typology – Descriptive statistics

Districts by industrial typology	Productive diversification (PD)				Total
	Low	Medium -low	Medium -high	High	
Textiles and Apparel	28.6	29.2	24.4	17.7	100.0
Leather and leather products	46.3	24.1	18.9	10.6	100.0
Household goods	23.8	20.0	25.9	30.4	100.0
Jewellery and musical instruments	41.0	15.1	22.0	21.9	100.0
Food products	12.1	23.4	25.7	38.9	100.0
Machinery and equipment	22.7	28.4	25.0	23.9	100.0
Basic and fabricated metal	24.7	30.8	22.5	22.0	100.0
Chemicals, rubber, and plastic	27.7	23.6	24.4	24.3	100.0
Transport equipment	16.6	26.2	29.1	28.1	100.0
Paper products, publishing and	27.0	28.8	23.6	20.6	100.0
Others manufacturing industries	21.3	26.9	23.4	28.4	100.0

Total	24.8	25.2	24.9	25.0	100.0

Table B.2 provides estimation results of Equation (1) by quartiles of productive diversification (PD). The first column summarizes the overall district effect, whereas columns 2 to 6 display results by size class. The evidence shows that low-diversified districts significantly outperform high-diversified districts, thus supporting the hypothesis that specialisation helps performance, as in the traditional Marshallian model. In addition, when size classes are considered, the overall evidence does not show any specific result by size class, thus implying that districtual advantages associated with Jacobian diversification are not related to the firm size distribution in either low- or high-productive diversification districts.

Table B.2 – Regressions by quartiles of productive diversification (PD)

	Total	0-19	20-49	50-99	100-249	250+
Low	0.370**	0.209	0.745**	0.492	1.166	1.021
	(0.154)	(0.195)	(0.331)	(0.478)	(0.738)	(1.102)
Medium-low	0.233	0.164	0.108	1.155	0.923	2.151
	(0.187)	(0.233)	(0.333)	(0.732)	(1.199)	(1.388)
Medium-high	-0.198*	-0.241*	-0.165	0.0115	-0.0284	0.987
	(0.102)	(0.132)	(0.208)	(0.354)	(0.500)	(1.383)
High	-0.182*	-0.0480	-0.0483*	-0.0631	0.416	-0.503
	(0.107)	(0.143)	(0.020)	(0.381)	(0.466)	(0.825)

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Source: Authors elaboration on ISTAT (2015b)