The advantages of formalizing networks: new evidence from Italian SMEs

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Abstract

Using a large sample of Italian small and medium-sized enterprises (SMEs), we investigate the effect of business cooperation realized through a *"network contract"* on the economic performance of network members. We find that establishing a *formal* business network has a positive effect on a firm's gross margin ratio and exports, but not on profits. The advantages of this type of networking are stronger in the cases of: smaller firms; firms operating in traditional markets; firms operating in turbulent markets; firms located in less developed areas; and firms not part of an industrial district. The characteristics of a network (such as its size, geographical dispersion and the sectorial diversity of its members), also have an impact on firm performance.

Keywords: Formal business network, SMEs, economic performance
JEL Codes: D22, L24, L25, M21

1. Introduction

The networking activities of firms have been investigated both theoretically and empirically. In general, there is a consensus on the presence of positive economic returns from cooperation or interaction, while firms acting in isolation are systematically worse performers. In a recent work, Cai and Szeidl (2018) present the results of a field experiment in China, in which experimental business associations were organized for the owners-managers of small and medium-sized enterprises (SME). Monthly business meetings and interactions among network members, which lasted for one year, substantially and persistently improved firm performance, and learning and partnering were found to be active mechanisms. This study confirms the belief that being a member of a network is an important source of competitive advantage because it gives access to knowledge and resources at lower costs (Gulati and Higgins, 2003; Zaheer and Bell, 2005).

However, results from different studies are often poorly comparable, and one of the reasons is that a precise and generally accepted definition of business networks is still lacking (Jack, 2010).

As Hoang and Antoncic (2003) highlight, networking is often a self-reported activity that may refer to a continuum of interactions and collaboration levels, sometimes identified without a clear intention of membership expressed by firms. Even when networks are clearly defined, the effect of networking on firm performance is rather difficult to disentangle, since it is often contaminated by

other factors. A recent example is the work by Schoonjans *et al*. (2013), who analyzed the effect of *formal* networks. Since the latter are identified through participation in a Flemish government program based on managers' training and structured contacts among managers of small firms and large corporations, the effect of networking *per se* is mixed with the training effect.

Our paper contributes to the above literature in several ways. First, we adopt a clear-cut definition of business-to-business *formal* network. While Parker (2008) defines a business network as a group of entrepreneurs that voluntarily share knowledge and experiences, our definition is more stringent. The relationships among firms in the network are closer, have clear objectives (as we will see, the goals are co-producing, co-marketing, co-purchasing or co-operating in product or market development) and, most importantly, are stated using a specific legal instrument (the *network contract*) to which the signatory parties mutually and voluntarily adhere. This contractual instrument formalizes the cooperation and collaboration agreement among firms, while the specific objectives are intended to bring economic gains for network members and to overcome the limits of small and medium-sized enterprises (SMEs). Second, since firms that explicitly decide to sign the network contract are not receiving any other kind of relevant support (like training programs or other activities sponsored by the government), the identified effect can be directly related to networking and is not mixed with the effect of other policy measures. Third, we provide evidence on the effects of networks in some particular environmental contexts characterized by lack of infrastructure, higher uncertainty or by a lower presence of social capital, where the information-sharing channel of networking ought to be particularly valuable. To the best of our knowledge, this latter dimension of heterogeneity has not been explored in the literature. Finally, from a methodological point of view, our analysis is one of the few that rely on longitudinal data and firm fixed-effect methods. In doing so, we aim at eliminating the potential bias in estimates arising from self-selection of specific firm types into networking due to *unobservable* firm characteristics, such as a firm's specific culture, the management style or the owners' preferences.

We obtained our longitudinal sample by merging three datasets, one including information on all of the network contracts signed from 2010 to 2014, one including economic and financial data for a very large sample of Italian companies, and one including information on exporting activities of

Italian firms. We then investigated the effects of network participation on different measures of performance. We focused on SMEs for several reasons. First, they are very relevant to the Italian economy. Moreover, as compared to micro firms, for which the importance of personal social ties is high, there is a lower personalization of relationships. Finally, cooperation and collaboration among SMEs is much simpler than the complex inter-firm relationships among large companies, which often materialize as joint ventures or technological alliances.

Our findings show that network agreements increase the value added per unit of sales, a proxy of the gross margin ratio, as well as the export propensity of participating firms, while the effects on profits are negligible. After splitting our sample according to specific factors, some interesting patterns emerge: the network effect is stronger for smaller firms and those located in underdeveloped areas or operating into traditional sectors. Moreover, we find that formal networks are particularly useful outside industrial districts and in more turbulent markets, where collecting or sharing information is expected to be particularly important.

We organize the remainder of the paper as follows. The next two sections review the literature on networking and economic performance and describe the specific Italian context. Section 4 discusses the main methodological concerns and presents our empirical strategy, while Section 5 describes our database. Sections 6 and 7 present and discuss our main results, and Section 8 concludes.

2. Theoretical background and literature

Two main fields of investigation have emerged in the literature on firm networks, as highlighted by Hoang and Antoncic (2003): the first focuses on the main factors influencing network formation, while the second analyses the effects of networking on firm performance. The latter strand of literature pinpoints several channels through which networking can improve performance. First, frequent interactions among firms, combined with the presence of common and explicit objectives, increase the level of reciprocal trust and reduce the risk of opportunistic behavior. Therefore, networking reduces transaction costs and enhances operational advantages, especially in the case of SMEs (Lin and Lin, 2016). Second, firms involved in networks agreements typically share

resources more easily, benefit from scale economies without bearing the disadvantages of the large size (Watson, 2011), and have flexible access to resources at a reduced cost (Li et al., 2015). Third, entering formal networks stimulates information sharing and increases cooperation and coordination along the supply chain, with the expected facilitation of knowledge flows and technological improvements (Vanhaverbeke et al., 2009). This mutual exchange of information stimulates product and process innovation (Schott and Jensen, 2016; Mazzola et al., 2016), but also enhances foreign market knowledge and exporting (Stoian et al. 2017).

Empirical research confirms the advantages of networking, at least in the case of SMEs and networks created on a strong voluntary basis. On the contrary, results are mixed and more difficult to interpret when scholars adopt "weak" definitions of business networks and when other kinds of cooperation among larger firms are investigated. For example, Schoonjans et al. (2013) focus on the whole population of East-Flanders SMEs during the period 1992–2008, and analyze the effects of a government program, named PLATO, aimed at favoring contacts among SMEs managers by organizing training sessions and discussions with large firms' managers. While the results show a positive and significant effect of networking on net assets growth and value-added growth (+2% and +3%, respectively), it is difficult to disentangle the networking effect from the impact of managers' training. Watson (2011) provides another example. Using survey data on Australian SMEs in the period 1994–1997, he considers firms linked to *weak formal* networks (industry associations, business consultants or banks) as well as to *strong informal* networks (other firms in the industry, family and friends), finding that only some specific types of formal network (i.e., business consultants) have a significant impact on firms' survival and growth.[1] Park et al. (2010), analyzing a large sample of manufacturing firms in Korea (mainly SMEs) in the period 1994–2003, find evidence that networking (in the *weak* and *formal* form of industrial clustering) has a positive effect on sales growth and survival, while other types of interaction (i.e., subcontracting) have a negligible effect. Lechner et al. (2006), using data from a survey study on CEOs and founders of venture capital firms, report a generally positive effect of networking on firms' size growth. Their

[1] See also Nunes et al. (2017), who adopt a similar approach to analyzing the relationship between formal and informal networks and innovation for a sample of Portuguese firms.

data on networks, self-reported by respondents, include both formal networks (technological alliances, marketing information networks) and informal networks (relationships with other firms based on strong personal relationships with individuals such as friends, relatives, long-standing colleagues). Havnes and Senneseth (2001), analyzing a sample of more than 1700 SMEs operating in eight different European countries, find no short-term benefits from networking[2] in terms of employment or sales growth. However, firms involved in alliances and networks exhibit, in the long-run, an increase in the geographical extension of their market. The evidence for large firms is less clear-cut, probably because of the more complex goals of the relationships, often focused on advanced technological cooperation rather than on exploiting simpler synergies in production, commercialization or market development. Ritala (2012) finds for a sample of Swedish firms that collaboration among competitors has a positive effect on profits, but his evidence is based exclusively on firms employing more than 100 workers. Mixed results are, instead, reported by Koka and Prescott (2008), who analyze formal alliances among medium-sized and large firms in the steel industry in 40 different countries, using sales per employee as a performance measure. While firms are found to benefit from alliances in relatively stable environments, in periods of radical changes, networking appears to be negatively related to performance.

As is evident from the above survey, how to define a network of firms (formal or informal, strong or weak), as well as the understanding of the content of the collaboration among network members, are two crucial points of controversy.

Clusters of firms (i.e. industrial districts), for example, represent a rather *weak* definition of *formal* networks, in that cooperation, innovation, and the sharing of information flows is supported only through mild (and often indirect) inter-firm linkages (Li et al., 2015). Similarly, weak formal networks can be represented by groups of firms that, driven by the desire to achieve a common goal, indirectly interact through the mediation of institutions, specialized agencies or trade organization, which promote information sharing. In both cases, the explicit voluntary adhesion to

[2] The information is self-reported, since firms are asked if they cooperate with other firms in areas such as expanding product spectrum, sales, financing opportunities, etc.

the network, the direct interaction among members (i.e., cooperation in production or marketing), and the clear specification of the goals to be pursued are not guaranteed.

Our paper, in dealing with firms that sign a *network contract* and that specify the objective of their relationship, focuses on a restrictive (i.e. *stronger*) type of formal network. It is similar in spirit to the works of Parker (2008), who proposes that one of the most important aspects of networking is a clear and explicit voluntary adhesion of members, and Huggings (2001), who underlines the importance of using contractual agreements.

The impact of networking on performance can vary according to the different characteristics of network members and of the network itself. First, we expect smaller SMEs to benefit more from scale economies in operational activities, while larger SMEs may be more interested in sharing experiences or resources for opening new business opportunities. Second, firms operating in less favorable environments (i.e., underdeveloped areas or turbulent sectors) are expected to gain more from networking. For example, considering the well-known historical divide between the North and the South of Italy; it is possible that the lack of resources or infrastructures of southern regions can stimulate the decision to enter networks, thereby avoiding isolation. In similar vein, we expect firms operating in more uncertain environments to obtain higher returns from formal networking, as these are the settings where access to additional information and resources is particularly valuable. Third, we expect that the benefits from networking are stronger for firms operating in more innovative industries. Fourth, the strong formal agreement that we analyze may overlap with other kinds of weaker formal networks (or even with informal networks). In such cases, because the firms involved may already be able to access valuable information and resources through the pre-existing link, we expect that the additional effect of signing a network agreement will be small. This is particularly relevant in the Italian production system, characterized by specific geographical areas with strong industrial specialization (i.e., industrial districts).

Finally, some scholars go beyond the link between the participation in a network and performance and analyze the characteristics of the network itself (Gulati and Higgins, 2003; Brand et al., 2018). Goerzen and Beamish (2005) find a clear positive link between the size (in terms of members) of the network and performance. Lechner et al. (2006) confirm the positive relationship between the

number of members and performance but argue that the explanatory power of network size is limited and highlight the importance of network type (e.g., the reputation of members and goals to be pursued by the alliance). One important feature of the network is the geographical distance between firms, a proxy for the intensity of interactions that can be activated. Goerzen and Beamish (2005), for example, worked on a sample of subsidiaries of 580 Japanese MNEs, and found that the geographical dispersion of network partners has a negative impact on firm profitability. Another relevant characteristic of the network is the heterogeneity of its members (Tan et al., 2015; Rauch et al., 2016). While high diversity may benefit a firm's performance by increasing the network's information basis and scope for innovation, it may also have a detrimental impact due to fewer opportunities of interaction and high coordination costs. Goerzen and Beamish (2005) defined network diversity according to the number of different industries involved in the agreement and found a negative effect of diversity on profits. Similarly, the negative impact of diversity (measured by heterogeneity in partners' sizes) on performance (measured by sales growth) has also been recently confirmed by Parida et al. (2016), who analyzed survey data from 134 Swedish firms.

3. A strong formal network: the Italian network contract

In an attempt to stimulate technological innovations and improve the competitiveness of SMEs, the European Union adopted the Small Business Act in 2008, which contained provisions applied to small firms. It instructed governments and institutions to "*think small first*" when establishing policy and law. In order to implement the above guidelines, in 2009 the Italian legislator enacted a law introducing a specific business agreement labeled "*contratto di rete*" (network contract). The network contract is a legal and economic means of strategic co-operation between businesses which, by signing it, mutually agree to implement a common program by co-operating in manners and areas relating to their own activities, exchanging information, knowledge, and/or services of an industrial, commercial, technical or technological nature. The basic requirements of the network contract include the statement of the strategic goals, the identification of a network program that specifies the activities and investments required to implement it, and the rights and duties of each participant (Scagnelli and Cisi, 2015). According to the proponents of the law, by setting up such

strong and formal networks, firms can rationalize costs and internal organization procedures.[3] Benefits are expected in terms of increased operating efficiency, product, process and market innovation, greater visibility on international markets, better chances to participate in (and win) tendering procedures, and the possibility to be targeted by specific industrial policy measures, at both the national and local (i.e., regional) levels (i.e. tax benefits, facilitated credit access, loan guarantees, non-repayable grants, dedicated training programs).

While similar types of partnership have been introduced in other countries[4], the Italian network contract, by featuring a model of legal cooperation inspired by the logic of auto-regulation between contracting parties, is particularly designed to overcome dimension barriers and to help SMEs to face market problems and opportunities better. Therefore, it is not surprising that it has become increasingly popular in Italy and has also been acknowledged by the OECD as an innovative and promising policy instrument "*which improves the typical informal collaboration between firms in their local enterprise clusters*" (OECD, 2014, p. 117).

To date, the empirical evidence for the Italian network contract, mainly drawn from institutional-level studies, is scant and often inconclusive. Bentivogli et al. (2013) focus on the determinants of networking. Using as a sample the first 1,000 firms that signed a network contract, they estimate a Probit model and find that firms located in the Southern or North-Eastern regions of the country, as well as firms characterized by larger size and larger revenue growth, have a higher probability of entering network agreements. Colombo et al. (2014) present the first investigation on the effects of network contracts on performance. Using a sample of 6,000 network firms and 70,000 non-network firms, they show that the probability of EBIT improving is positively (even if marginally significant) related to networking, while no effect is found for sales growth. More recently, Confindustria (2016 and 2017), by applying a propensity score matching to a control for observable characteristics influencing networking decisions, has found that network firms are more productive (in terms of value added per worker) as well as more oriented to foreign markets (i.e.,

[3] It is also possible to detach some workers from one firm to another within the network, as well as to organize joint recruitment procedures and joint hiring of workers.

[4] For example, in France firms can set up an Economic Interest Grouping (EIG), a legal entity adopted also by the European Union in the form of the European Economic Interest Grouping (EEIG), with the aim of promoting the formation of international networks of firms. With respect to EIGs and EEIGs, the Italian network contract is more flexible and allows member firms to retain their independence and autonomy. For more details, see Ferrari (2010).

they export more), and that networking impacts positively on firms' size growth (both sales and employment). However, it should be noted that the studies mentioned above for Italy are of a descriptive nature. They rely on cross-sectional data and are, in general, unable to employ methods (e.g., instrumental variable or fixed-effect estimation) to control for self-selection into networking due to unobservable characteristics.

4. Methodology and empirical strategy

A simple way to evaluate the impact of networking on firms' performance is to estimate the difference between the performances of firms involved in network agreements around the date of the signature of the network contract. However, a potential concern is that such an approach fails to control for aggregate trends and for other regional, time or industry specificities. A possible solution is to use a control group of firms not involved in networking, but operating within the same sector and of a similar size (Bennedsen et al., 2007). Even so, the most recent economic literature on networking highlights potential endogeneity problems regarding the relationship between entering a network contract and unobservable firms' characteristics. Bodnaruk et al. (2013) argue that the probability of engaging in business alliances, and then participating in network agreements, is strongly influenced by the quality of corporate governance. The latter strictly depends on the quality and ability of the managers (or of the owners, in the case of small firms without managers), so that identification of the causal effect crucially depends on the possibility to separate these unobservable factors, as well as other observable factors, from the presence of network alliances. Our partial solution to this issue is (i) the inclusion of all the available controls for observable factors, reflecting differences among firms in relation to financial/economic aspects, and (ii) the use of a fixed-effects estimator to deal with unobservable factors, such as specific features like firm tradition, culture, or firm "quality". Such unobservable factors undoubtedly influence the probability of being involved in network agreements, and ignoring them may lead to an over-estimation of the causal effect of networking on performance. If we are willing to assume that firm culture or the

ability/quality/capacity of managers are stable over time, any potential endogeneity problem can be solved through the inclusion of firm fixed effects in the following regression model:

$$\pi_{it} = \alpha + \beta NET_{it} + \delta Z_{it} + \eta D_t + \omega_i + \varepsilon_{it} \qquad (1)$$

where π_{it} represents the selected measure of performance and NET_{it} is a dummy variable identifying the networking status that may change over time, turning on the year after the firm signs a network contract. Z_{it} is a vector of firm-level time-variant controls, such as firm size, age, capital intensity and degree of vertical integration. D_t is a vector of year fixed effects (i.e. dummies for the specific year of analysis) aimed at capturing macroeconomic determinants of performance. The last part of the equation, $\omega_i + \varepsilon_{it}$, indicates the error term: ω_i is a time invariant error component that is potentially correlated with the presence of network alliances, while the second component ε_{it} is a purely white noise error term**.** We consider both firms that during the period enter a network contract and firms that during the period do not use such instrument (i.e. the control group). The estimated coefficient on the dummy NET_{it} represents the difference in the level of performance due to participation in such a type of formal network.

Our empirical strategy consists in the estimation of equation (1) for the whole sample, following different model specifications in order to test the robustness of the results, and then repeating estimates for different subsamples (accounting for firms' size, geographical location, sector of activity). The main aspect of interest is the coefficient for the dummy variable NET_{it}, in the full sample and for each subsample. Our preferred estimates take into account the panel structure of the database and include firm fixed effects as well as year-specific fixed effects.

5. Data

Our main source of information was INFOCAMERE, which collects data on all the network contracts signed since the introduction of the network contract until 31/12/2015 (i.e. the entire population). For each contract, we were able to identify all partners and classify them as self-employers, micro-firms, SMEs or large firms. We had information on the network name, on the main objects of the agreement, and on the month and year in which the network had been set up. In

order to evaluate the effects of the network agreements on performance, we needed to retrieve economic information for each member. We decided to focus on the effect of networking for SMEs, as highlighted in the introduction, in order to reduce heterogeneity and because of the importance of networking for them. Using the tax code as a firm identifier, we matched the INFOCAMERE data with the AIDA dataset (provided by Bureau Van Dijk), which contains the financial statements of the entire population of Italian firms obliged to register their financial statements, i.e. limited companies and corporations, and we selected only firms with a number of employees between 10 and 250.[5] Finally, we completed the economic information by merging the two above datasets with ISTAT-COEWEB data on exporting activities of Italian firms, again using the tax code as a firm identifier.

We were able to collect financial statement information for the period 2008-2014 for a sample of 167,622 firms. We structured our database as an unbalanced panel, using all available information on Italian SMEs. We deflated all the monetary values according to the Italian Consumer Price Index. Table 1 shows some statistics on the adoption of network agreements for the whole population of SMEs included in the AIDA database. As is clear from the figures, the bulk of contracts refer to the most recent years.[6]

[Table 1 about here]

Even if the network agreement is immediately effective, it is reasonable to assume that its economic effects take some time to become apparent. Since it is very difficult for a formal network officially born during the year to exert its effect before the end of the year, we considered the year of the contract to be a sort of "transition period" in which the network has been formed but its effects cannot influence the financial statements, irrespective of the month in which the contract has been signed. We classified the financial variables relative to that year as "pre-network" observations, but the results were substantially stable if we treated such observations as missing values.

[5] Note that, for each firm in the AIDA database that enters a network agreement, we have information about the whole network, even if for some members we do not have financial data.

[6] There was a jump in 2012, and the small number of firms participating in the networks in the years immediately after the introduction of the law is one drawback of our analysis.

Given the large size of the database and the presence of unreliable or incomplete financial statement entries, we performed a careful data cleaning procedure. First, firms that had become inactive during the period, as well as firms involved in liquidation processes, were excluded from the sample for the entire period of investigation. Moreover, we paid particular attention to outliers reporting unreliable or out-of-scale financial statement data: we excluded all firm-year observations reporting negative value added, as well as value added too large in comparison to the other financial dimensions (for instance above the 99th percentile in terms of value added per unit of revenues and value added per unit of labor cost). Finally, only geographical areas (Italian provinces) and industries (at two-digit NACE disaggregation) where at least one network agreement had been signed were considered. We used complete information on each network, even if only corporations and limited companies can be exploited to evaluate the effects of networking on performance. We accordingly created specific indicators considering all network members, including micro-firms, self-employers as well as large corporations. First, we counted the total number of members to create an indicator of the size of the network. Secondly, we computed a geographical dispersion index by dividing the number of provinces in which members are located over the total number of network components. Third, we generated an indicator of network dispersion along the value chain, using information on the sectoral activity of each member. As in the previous case, we used the ratio of the number of two-digit sectors in which members are active to the number of network components. Those indicators, relative to the network itself, are reported in the bottom panel of Table 2, with reference to the situation at the end of 2014. Half of the networks comprise fewer than six members. The median network has 18% of members located outside the province, and shows at least one member operating in different two-digit NACE codes, while very heterogeneous networks are less commonly observed.

[Table 2 about here]

As dependent variables, we used three different measures of performance at the firm level, computed according to financial statements and export information. First, we considered an indirect measure of the Gross Margin ratio, the value added per unit of revenues, which reflects the capacity

of the firm to manufacture goods (and provide services) and sell them to the market. Secondly, we analyzed profitability using the Return of Assets indicator (ROA), computed as EBIT margin over Total Assets[7]. Finally, the export share, defined by the ratio of foreign sales over revenues, measures the capacity to enter foreign markets, an aspect rarely investigated in the empirical literature, as argued by Stoian et al. (2017).

As right-hand side variables, we used controls to account for the observed heterogeneity of performance among firms, drawn from the managerial literature as well as from empirical studies on the determinants of performance. Apart from age (years after foundation), size (the logarithm of sales), and physical capital intensity (physical assets over sales), we included a proxy for firms' vertical integration strategies, which was computed as the share of external costs (costs for the purchase of components, materials and services) over total costs.[8] The aforementioned controls gradually entered our model specification, in order to test the stability of results. Descriptive statistics are presented in Table 3.

[Table 3 about here]

6. Results

a. Empirical findings on the whole sample of Italian SMEs

We begin by addressing the general impact of *NET* on performance. Given the recent introduction of network contracts in the Italian legislation, the identified effects should be interpreted as short-term impacts. Unless otherwise specified, the reported estimates are based on fixed-effects models, which duly account for time-invariant unobserved heterogeneity in firms' drivers of performance.

[Table 4 about here]

Table 4, columns 2-5, reports the estimates for three specifications which use value added per unit of sales as the dependent variable. Firms involved in network agreements exhibit a higher gross

[7] While ROA is one of the most commonly used measures of profitability, we also computed ROS (EBIT margin over total sales) and ROE (EBIT margin over equity), obtaining similar findings for all the regressions. Results are available upon request.

[8] A higher share reflects the fact that the firm, instead of organizing most of the activities in-house, relies on contracts with third parties for the supply of inputs and components.

margin ratio, as shown by the positive and significant coefficient estimated for the dummy *NET*. The result is robust to different model specifications, which always control for firm fixed effects, year specific effects, as well as different time-variant firm characteristics, among them vertical disintegration, physical capital intensity and export propensity. The magnitude is low, since, after networking, value added per unit of revenues increases by about 0.005 (half percentage point) in absolute terms, with an increase of near 2% in relative terms. Size, as expected, shows a positive impact on value added, but the negative sign of its squared term suggests that, above a certain threshold, internal coordination costs limit the exploitation of scale economies. Past experience, proxied by firm's age, is an important aspect fostering performance, as expected. The negative signs recorded for vertical disintegration and physical capital intensity are once again in line with expectations. Vertical disintegration increases when external costs increase, with an expected negative effect on value added. The inclusion of this regressor is important because it excludes that the effect on value added is due to different vertical structures among firms. Similarly, a higher weight of physical assets implies higher amortization and depreciation, which enter negatively in the determination of value added. The last two controls, export share and its squared term, show a somewhat unexpected pattern. In general, we should expect a positive effect of international sales on competitiveness, because only the best firms are able to export. Our estimates show a negative sign for the linear term and a positive sign for its square, highlighting a U-shaped relation. In the case of low export levels, firms are marginal exporters and, probably, selling abroad implies additional costs that exceed the positive returns. By contrast, strong exporters, which are, by definition, highly competitive, show a higher value added.

If we turn our attention to profitability, the results of networking are substantially inconclusive. The sign of estimated coefficients is positive but poorly significant, suggesting that the effect of *NET* on ROA is negligible. This evidence is substantially stable across all different model specifications, and is probably reflecting the presence of some initial costs of networking. Profits appear to be higher in correspondence to vertically disintegrated firms, high values of physical assets and high exporting shares.

Finally, the last two columns of Table 4 report the results of networking on export propensity, measured as the ratio between exports and total sales. Our estimates show that, after entering formal business networks, SMEs export more, suggesting that network contracts are valid instruments with which to share resources, experience and information with the goal of improving the presence in foreign markets. The other controls show, more or less, the expected sign: both age and vertical disintegration are positively associated with export share, suggesting that older firms and firms focusing more on core activities have better chances of selling abroad. Finally, also in this case, size impacts non-linearly on exports, but the U-shaped relation is now inverted: small SMEs show only a limited export capacity, while larger SMEs are associated with a higher export propensity. This finding confirms the importance of networking for boosting the export potential of Italian small and medium-sized firms. Exporting is still a strategy mainly pursued by larger SMEs, but sharing resources and experience through networking is a promising way to enhance the exporting capacity of small firms as well.

Summarizing, networking has a positive and significant impact on two of our three measures of performance.[9]

The fact that wider sales margins do not result in higher overall profitability is a quite intriguing result. One possible explanation is that it takes time in order to observe a positive effect on profits, especially if initial investments and set-up costs have to be borne to enter foreign markets, and if a critical mass of sales in foreign market must be reached.[10] We explored further in this direction by running separate regressions for firms that do not export (74% of observations), firms that export below the average (17% of observations) and firms that export above the average (9% of observations).[11] Our results (not reported but available upon request) show a positive and significant impact of *NET* on ROA only for the last category. Therefore, "big exporters" involved in

[9] For the sake of comparison, Table 4 reports the results of simple OLS models which pool all firms and year observations. While the FE and OLS estimates are not very different in the case of value added, the impact of networking on exports is almost twice as large in the OLS models. Similarly, the impact on ROA is negative and statistically significant according to the OLS estimates, while it is always insignificant in all the FE models. Overall, these differences suggest that uncontrolled firm characteristics may have biased some of the results obtained in the literature. Hence, unless differently stated, the rest of the paper focuses on the results of fixed-effect models.

[10] We thank an anonymous referee for having raised this issue.

[11] For exporters, the average share of sales in foreign markets is 24%.

networking exhibit higher profitability, differently from "small exporters" and from firms focusing exclusively on the domestic market.[12]

Finally, it is interesting to investigate also the impact of *network contracts* on firm employment.[13] Unfortunately, we have a considerable number of missing observations, and when the data are available, we are not sure that part-time workers have been correctly computed (i.e. if their hours worked are converted into full time equivalents). Bearing this in mind, Table 5 presents results of estimations of fixed-effects models in which the dependent variable is the logarithm of the number of workers. The results clearly point towards the presence of a positive impact of *NET* on firm employment.

[Table 5 about here]

b. The role of firm size

Even if we limit our analysis to SMEs, it is clear that objectives and characteristics of firms that employ 10 workers and firms that employ 250 workers may diverge, so that the main drivers of investment in networking may be remarkably different. We focused on this aspect by splitting our sample into two groups, identifying small (from 10 to 49 employees) and medium-sized SMEs (between 50 and 250 employees). As shown in Table 6, the evidence on the gross margin ratio seems driven by the subsample of small SMEs.[14]

[Table 6 about here]

For the subsample of large SMEs, instead, the sign is negative, but not statistically significant, suggesting that the main effect of networking is not on value added. While the effect of networks on profits remains negligible for both subsamples, the impact on exports is found to be stronger for larger SMEs (0.017 as compared to 0.006 for the total sample), and weaker (0.003 as compared to 0.006) for smaller SMEs. These results suggest that smaller SMEs can benefit more from scale

[12] The same result emerges if we add to the model in Table 4, column (8), the interacted term NET*EXP among the regressors. The coefficient on the interacted terms turns out to be positive and significantly different from zero. Results are available upon request.

[13] We are indebted to an anonymous referee for suggesting this angle of analysis to us.

[14] The coefficient (0.0067) is larger than the one reported for the whole sample (0.0055), and the statistical significance is higher as well.

economies in operational activities, while larger SMEs may be more interested in sharing experiences or resources to create new business opportunities.

c. *The role of the external context: geographical divide, market turbulence and industry classification*

The other aspects of interest relate to the influence of the external socioeconomic or technical environment in which firms operate. First, we consider economic and infrastructural differences across Italian macro-regions. Table 7 presents separate regressions for different Italian macro areas[15]: North-West, North-East, Centre and South Italy. The South of Italy is commonly considered to be the most underdeveloped area, lacking infrastructures and services for firms; the Centre represents an intermediate situation; while the North-East and the North-West are more developed and characterized by a prevalence of small and medium-large firms, respectively. Our results show that the effect of networking is not homogeneous across these geographical areas. While in the North-West, *NET* never significantly affects our three performance measures, in the North-East it seems to have an impact only for export propensity. The situation changes dramatically if we consider the subsample of firms located in the Central and Southern regions of Italy: here, as expected, the positive outcome of networking is higher compared to the general case. After entering networks, value added per unit of revenues increases by 0.01 in magnitude (with respect to 0.0055 for whole sample), while export share increases by 0.08 (as compared to 0.0062 for the whole sample) in both central and southern Italy. We can conclude that formal network agreements are more effective in less developed areas, where sharing resources, information and experience is a practical and cost-saving way to prevent isolation and compensate for the lack of infrastructure or services.

[Table 7 about here]

While the geographical location accounts for economic and infrastructural context, also demand specificities may influence the expected benefits from networking. We used a measure of the

[15] The approach of grouping firms according to four homogeneous socioeconomic subsystems is very common for empirical studies focusing on Italy.

volatility of sales at a fine-grained industry level to identify firms that operate in more turbulent environments. In such contexts, networking can be particularly useful for collecting information, experience and sharing resources with the aim of reducing uncertainty and protecting firms from sales fluctuations. We computed our volatility measure as the average standard deviation of yearly change in log sales over the period 2005-2010[16], using the median computed across all activities to disentangle low versus high volatile sectors.

[Table 8 about here]

The results, reported in Table 8, confirm the positive effect of *NET* on value added and export propensity. Firms operating in turbulent markets show a higher effect on value added (0.0066 as compared to 0.0041), a finding that suggests that in volatile environments the information/experience and resource flows partially protect networking firms from uncertainty. Conversely, the coefficients on export shares are similar across subsamples. The last angle of the analysis focuses on the innovative/operative environment characterizing each industrial activity. In this regard, SMEs were split into four homogeneous groups of industries (i.e. Science Based, Specialized Suppliers, Scale and Information Intensity and Supplier Dominated), following the well-known Pavitt's taxonomy[17]. Table 9 presents the results separately for the four sub-samples. The large majority of Italian SMEs operate in the specialized suppliers or supplier dominated sectors, in line with the view that Italian firms are more focused on traditional industries than other countries (Germany, France and the UK, for example). Firms operating in specialized suppliers industries seem to benefit more from network agreements. For such firms, entering a network implies an increase in value added per unit of revenues (+ 0.009), an increase in export share (+0.007) and, rather surprisingly, an increase in ROA (+0.01). In all cases, the impact is higher with respect to the results for the whole sample. Similar considerations, but limited to the case of the export share, are also valid for supplier dominated industries: the coefficient (0.008) is larger than the one recorded for the whole sample. Therefore, it is mostly firms operating in traditional sectors

[16] Volatility is computed at the NACE 3-digit classification (over 350 sectors), using the entire AIDA dataset, including the years before the introduction of the network contracts, in order to minimize endogeneity concerns.

[17] The Pavitt's taxonomy is widely used to classify sectors according to their main innovation characteristics. Bogliacino and Pianta (2016) have recently extended the Pavitt's taxonomy in order to classify both manufacturing industries and service sectors.

that gain advantage from networking, contrary to our *a priori* expectation that network members in innovative industries could significantly benefit from information sharing.

[Table 9 about here]

d. The overlapping of weak and strong networks: the role of industrial districts

Networking is a multifaceted phenomenon, and the presence of strong formal network agreements, such as the Italian *network contract*, cannot exclude the existence of other weaker forms of cooperation among firms. The interaction of multiple level of networking offers a new interesting angle of analysis, which has been rarely investigated in the past. Since the signature of network contracts is not limited by any economic/geographical clause or by any pre-existing kind of cooperation, we add into the analysis the presence of industrial clusters (labeled *industrial districts*), a specificity of the Italian production system. Industrial districts, clearly identified by ISTAT (the official Italian statistical institute) are well defined geographical areas with strong industrial specializations and strong cohesion at social/institutional level, and the cooperation among firms is typically promoted and supported by local institutions, generating links that closely resemble the weak ties identified by Li et al., (2015) for industrial clusters. Some firms, which are already mutually cooperating through weak ties, may decide to strengthen and formalize the relationship by signing the network contract.

[Table 10 about here]

Table 10 shows that firms located outside industrial districts strongly benefit from networking in terms of both value added and export share. Conversely, for firms located within industrial districts, the effect of *NET* on the gross margin ratio disappears, a result suggesting that, in the case in which firms are already cooperating, the main driver for entering network contracts seems to be the desire to increase exports.

7. Network characteristics and partners' economic performances

We contribute to the debate on the relationship between the characteristics of networks and performance by running OLS regressions on the subsample of firms that signed a network contract

during the period.[18] In order to reduce heterogeneity, we saturated our OLS specification with controls, using the same variables in the aforementioned Z_{it} vector, as well as numerous industry-year (i.e. two-digit NACE dummies interacted with years) and region-year interactions (i.e. regional dummies interacted with years). On the basis of previous works, we decided to focus on three main aspects: network size, network geographical dispersion and network sectoral diversity.

The number of members was our measure of network size, while network dispersion was obtained by computing the ratio between the number of provinces in which firms operate and the number of participants. Finally, we computed network sectoral diversity as the number of different sectors (NACE two-digit codes) in which network firms are active divided by the number of members. Table 11 reports the estimated coefficients.

[Table 11 about here]

Columns 1-3 show that the number of partners positively influences value added per unit of revenues as well as profitability (ROA). The small magnitude of the coefficient represents the marginal effect from increasing by one member the size of the network. This evidence is substantially in line with the results obtained by Lechner et al. (2006) and by Goerzen and Beamish (2005). By contrast, the number of network participants seems to be less effective in increasing the export share of a member. As far as network diversity is concerned, the results are only significant for the profitability ratio, and show a negative impact of sectoral diversity on ROA, in line with the findings reported by Goerzen and Beamish (2005) and by Parida *et al.* (2016). Finally, the last three columns show that the increasing geographical distance among partners does not have an impact on either value added or profitability, but seems to reduce the incentive for network members to sell abroad. After entering highly dispersed networks, firms seem to prefer to exploit new national markets that become accessible through networking, instead of selling in foreign markets. This is an interesting pattern, which has never been highlighted in the literature.

8. Conclusion

[18] Since time invariant controls (i.e. network characteristics) are not changing over time, we cannot use the fixed effect estimator. However, the fact that firms are pre-selected among those firms entering a network mitigates the potential endogeneity problems.

This paper has presented a large-scale empirical analysis of the effects of membership in a formal business network on the performance of SMEs. We have analyzed a representative and longitudinal sample of Italian SMEs for which we collected financial statements, export data, and information on membership in a specific type of business network, for the years 2008–2014. Networks are set up by signing a *network contract*, in which the details of the agreement and the goals to be pursued are clearly specified. Our econometric analyses estimated the impact of network contracts on several measures of performance. To eliminate, or at least reduce, the bias in the estimated impacts potentially arising from the non-random selection of specific firm types into networking – a selection likely to be driven by firms' *unobservable* characteristics – we relied on a fixed effect estimator that purges firm time-invariant specificities. We found a generally positive and significant effect associated with signing a network contract on a firm's exports and gross margin ratio. While for the full sample there was no discernible effect on profits, a positive impact was found for the subsample of firms that export a relatively high percentage of their sales.

We then investigated the influence of the socio-economic environment and various firm structural characteristics. First, by splitting our sample into small and medium SMEs, we found that networking increases the value added for small SMEs, while the effect on export shares is larger for medium SMEs. Second, for firms located in more underdeveloped areas the advantages of networking are stronger, in terms of both their gross margin ratio and export propensity. Finally, investigating differences across industries through the Pavitt's taxonomy, we observed that the results on gross margin ratio and exports are mainly driven by firms operating in more traditional sectors (i.e., specialized suppliers or supplier-dominated industries).

Our empirical evidence seems to support the idea that networks are more beneficial for firms operating in less favorable environments or characterized by an intrinsic weakness. In this sense, stimulating the sharing of resources (as well as interactions and/or information exchanges) through networking can be a win-win opportunity for Italian SMEs. Networking can provide an opportunity for SMEs to achieve a critical mass in terms of resources, information, and experience, and can help to overcome a lack of infrastructure and isolation, which are typical problems faced by SMEs in less developed areas. Similarly, networking seems to help the performance of SMEs in highly

turbulent environments. In fact, the gross margin ratio is higher for members of network contracts when their sales volatility is high.

Another important contribution of our work is the explicit consideration of the overlap between weak and strong forms of networking. Taking advantage of the Italian industrial structure, we identify well-defined local areas (the so-called industrial districts) characterized by a high level of relatively weak forms of cooperation. Our results show that formalizing network agreements through contracts has a higher impact on the gross margin ratio for firms located outside industrial districts.

Finally, the results regarding other structural aspects of networks, such as the number of ties and partner diversity (in terms of geographical location and sectoral activity), are mixed. Network size shows a positive effect on the gross margin ratio and profits of SMEs, while the sectoral diversity of members is negatively related to profits. The geographical dispersion of partners shows a negligible effect on the gross margin ratio and profits but also seems to limit the pressure for international sales.

In this study, we have only been able to identify short-term effects because it was only after 2012 that a substantial group of firms began entering network agreements, leaving us with just two years of data in the post-network period. It should be noted that our observations partially overlap with the recent economic crisis and it would, therefore, be interesting to assess whether this resulted in an underestimation of the effects that would prevail in normal circumstances. Finally, even if we believe that our estimation techniques are appropriate for attenuating any concerns related to omitted variable biases and self-selection into the treatment status, our results still come from observational data; hence, an interpretation in terms of direct causality between networking and economic performance should be treated with caution and further assessed in future work.

Given the above results, the main policy implications that we draw point towards devising incentives to stimulate SMEs to use such type of (formalized) networking. While there is a consensus on the potential benefits of network contracts, there have been also some criticisms of how the Italian government and the local authorities (mostly, the Italian Regions) implemented the law. Some scholars complain that the national and regional incentives for the firms that signed a

network contract are too fragmented and discontinuous across the years, and hope that a more generous, long-term and coordinated program will be implemented in the future (Confindustria, 2017). In similar vein, the OECD, while considering the Italian network contract as an example of good practice, notes that the focus of Italian policymakers is overly unbalanced towards giving SMEs incentives to innovate, and suggests to devote more effort and resources to other strategic goals, such as internationalization and growth (OECD, 2014).

Table1: Number of SMEs involved in Italian network contracts

Year	Networking SMEs	Networking incidence	N. of New networks	Networks at the end of the year
2010	28	0.02%	13	13
2011	311	0.2%	120	133
2012	979	0.6%	274	407
2013	1,921	1.4%	452	859
2014	2,558	1.9%	316	1,175
Total	5,797	0.6%	1,175	

Reported figures refer to the sample of SMEs and to network contracts with at least one SME among its members.

Table 2: Network contracts: incidence by size class, area, sectors and network indicators

	N. Networking firms	Network participation rate	
Size Class			
10-49 employees	346	3.3%	
50-250 employees	2,212	1.8%	
Geographical area			
North West	792	1.7%	
North East	782	2.2%	
Centre	538	1.9%	
South	446	1.8%	
Pavitt Taxonomy			
Science Based	235	3.7%	
Specialized Suppliers	529	2.9%	
Information Intensive	234	1.9%	
Supplier Dominated	1,096	1.6%	
Others	464	1.7%	
Total sample	2,558	1.9%	
Network indicators	Median	10th percentile	90th percentile
Network size	6	3	24
Network dispersion	0.187	0.02	0.555
Network diversity	0.373	0.02	0.666

Reported figures refer to 2014 (December).

Table 3: Descriptive statistics

Variable	Description	2014		2010	
		mean	s.d.	mean	s.d.
Gross margin ratio	Value added / Sales ratio (GMR)	0.35	0.19	0.33	0.19
ROA	EBIT over total assets	0.04	0.62	0.05	0.25
Export share (EXP)	Export / sales ratio	0.06	0.17	0.06	0.16
Export share squared		0.03	0.12	0.03	0.11
Size	Ln Sales	14.65	1.28	14.57	1.36
Size squared		216.26	38.12	214.04	40.32
Age	Years after foundation	21.30	17.51	17.45	18.66
Vertical disintegration	Costs of materials and services over Total costs	0.65	0.20	0.68	0.21
Physical capital intensity	Physical Assets over Sales	0.43	1.71	0.42	1.59
Dummies					
Networking (NET)	Probability of signing a network contract	1.90%		0.02%	
Exporting	Probability of exporting	25.81%		23.60%	

Table 4. The effect of network contracts on gross margin ratio (GMR), profits and export propensity

Dependent variables	Gross Margin ratio (GMR)				ROA				Export share		
Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
	OLS	Fixed-effect			OLS	Fixed-effect			OLS	Fixed-effect	
Networking (NET)	0.00402**	0.00611***	0.00546***	0.00558***	-0.00374**	0.000341	0.000565	0.000492	0.0115***	0.00624***	0.00625***
	(0.0174)	(0.00408)	(0.00682)	(0.00631)	(0.0377)	(0.840)	(0.739)	(0.769)	(0.0098)	(0.00306)	(0.00303)
Size	-0.0303***	0.131***	0.0831***	0.0819***	0.105***	0.0193	0.0333	0.0336	-0.0315***	-0.0513***	-0.0495***
	(0.00204)	(0.00142)	(0.000906)	(0.00098)	(0.003)	(0.418)	(0.189)	(0.183)	(0.003)	(0.000216)	(0.00321)
Size squared	0.000289	-0.0054***	-0.0036***	-0.0035***	-0.00329***	0.00124	0.000735	0.000726	0.00184***	0.00215***	0.00209***
	(0.123)	(0.00011)	(0.00151)	(0.00172)	(00.002)	(0.111)	(0.362)	(0.365)	(0.002)	(0.00988)	(0.000123)
Age	0.000187***	0.00386***	0.00285***	0.00292***	-0.00027***	-0.0055***	-0.0053***	-0.0053***	0.004***	0.00208***	0.00212***
	(0.00881)	(0.0002)	(0.0006)	(0.0004)	(0.001)	(0.000002)	(0.00003)	(0.00004)	(0.002)	(0.000107)	(0.00105)
Vertical disintegration	-0.486***		-0.125**	-0.125**	0.0268***		0.0310***	0.0310***	0.0289***		0.00481**
	(0.006)		(0.0103)	(0.0103)	(0.009)		(0.00134)	(0.00136)	(0.0018)		(0.0112)
Physical capital intensity	-0.000561		-0.000676*	-0.000677*	-0.00178***		0.00133**	0.00133**	-0.004		-0.0157
	(0.337)		(0.0567)	(0.0564)	(0.00088)		(0.0115)	(0.0115)	(0.327)		(0.973)
Export share	-0.0690***			-0.0600***	-0.0621***			-0.0326***			
	(0.0001)			(0.00463)	(0.002)			(0.00231)			
Export share squared	0.0797***			0.0466***	0.0852***			0.0500***			
	(0.0002)			(0.00011)	(0.00001)			(0.00365)			
Industry fixed effect	Yes	No	No	No	Yes	No	No	No	Yes	No	No
Year fixed effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm's fixed effect	No	Yes	Yes	Yes	No	Yes	Yes	Yes	No	Yes	Yes
Constant	1.072***	-0.475***	-0.0669	-0.0599	-0.786***	-0.397**	-0.519**	-0.520**	0.0470***	0.305***	0.290***
	(0.0003)	(0.00945)	(0.627)	(0.661)	(0.0004)	(0.0357)	(0.0122)	(0.0117)	(0.00462)	(0.00612)	(0.00018)
R-squared	0.654	0.027	0.090	0.091	0.002	0.002	0.002	0.002	0.232	0.020	0.020
Observations	946,997										
Number of firms	167,622										

Robust p-values in parentheses. Standard Errors are clustered at firm level, *** p<0.01, ** p<0.05, * p<0.1

Table 5. The effect of network contracts on firm employment

Dependent variables	Logarithm of Number of Workers		
Variables	(1)	(2)	(3)
		Fixed-effect	
Networking (NET)	0.0468***	0.0436***	0.0435***
	(0.0000)	(0.0000)	(0.0000)
Size	1.021***	0.930***	0.931***
	(0.0000)	(0.0000)	(0.0000)
Size squared	-0.0175***	-0.0133***	-0.0134***
	(0.0000)	(0.0000)	(0.0000)
Age	-0.0023**	-0.0014**	0.0015**
	(0.0002)	(0.0270)	(0.0165)
Vertical disintegration		-0.562***	-0.562***
		(0.0000)	(0.0000)
Physical capital intensity		0.00136	0.00137
		(0.295)	(0.293)
Export share			0.171***
			(0.0000)
Export share squared			-0.187***
			(0.0000)
Industry fixed effect	No	No	No
Year fixed effect	Yes	Yes	Yes
Firm's fixed effect	Yes	Yes	Yes
Constant	-8.464***	-7.614	-7.619
	(0.0000)	(0.0000)	(0.0000)
R-squared	0.184	0.201	0.201
Observations		877,369	
Number of firms		167,092	

Robust p-values in parentheses. Standard Errors are clustered at the firm level.
*** p<0.01, ** p<0.05, * p<0.1

Table 6: Effect of network contracts by firm's dimension

	10-49 employees			50- 250 employees		
VARIABLES	GMR	ROA	Export share	GMR	ROA	Export share
Networking (NET)	0.00672***	0.000459	0.00356**	-0.0000045	0.000143	0.0173***
	(0.00446)	(0.801)	(0.0424)	(0.984)	(0.965)	(0.00116)
Controls (from table 4)	Yes	Yes	Yes	Yes	Yes	Yes
Firm's fixed effect	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effect	Yes	Yes	Yes	Yes	Yes	Yes
Observations		864,667			82,330	
R-squared	0.091	0.002	0.020	0.213	0.037	0.026
Number of firms		152,173			15,449	

Robust p-val in parentheses. Standard Errors are clustered at firm level, *** p<0.01, ** p<0.05, * p<0.1.
Control variables are the same as reported in columns (4), (8) and (11) of Table 4.

Table 7: Effect of network contracts by geographical area

	North-West Italy			North-East Italy			Centre Italy			South Italy		
VARIABLES	GMR	ROA	EXP	GMR	ROA	EXP	GMR	ROA	EXP	GMR	ROA	EXP
Networking (NET)	0.00185	0.00298	0.00400	0.00372	-0.00297	0.00566**	0.00926***	0.00390	0.00825*	0.0102**	-0.00265	0.0083***
	(0.456)	(0.279)	(0.252)	(0.170)	(0.358)	(0.047)	(0.009)	(0.388)	(0.0524)	(0.0481)	(0.612)	(0.008)
Controls (from table 4)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm's fixed effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations		315,850			243,537			199,773			187,837	
R-squared	0.184	0.003	0.023	0.164	0.016	0.028	0.06	0.002	0.016	0.093	0.001	0.008
Number of firms		53,821			41,599			35,937			36,265	

Robust p-values in parentheses. Standard Errors are clustered at firm level, *** p<0.01, ** p<0.05, * p<0.1. Control variables are the same as reported in columns (4), (8) and (11) of Table 4.

Table 8: Effect of network contracts by industry-level sales volatility

	Low volatility			High volatility		
VARIABLES	GMR	ROA	EXP	GMR	ROA	EXP
Networking (NET)	0.00410*	-0.00116	0.00549**	0.00663**	0.00129	0.00585*
	(0.0757)	(0.606)	(0.0291)	(0.0359)	(0.646)	(0.0772)
Controls (from table 4)	yes	yes	yes	yes	yes	yes
Firm's fixed effect	yes	yes	yes	yes	yes	yes
Year fixed effect	yes	yes	yes	yes	yes	yes
Observations		405,039			541,958	
R-squared	0.061	0.002	0.031	0.118	0.003	0.013
Number of firms		69,854			97,768	

Robust p-values in parentheses. Standard Errors are clustered at firm level, *** p<0.01, ** p<0.05, * p<0.1.
Control variables are the same as reported in columns (4), (8) and (11) of Table 4.

Table 9: Effect of network contracts by industries classified according to the Pavitt taxonomy

	Science Based			Specialized suppliers			Scale and information intensive			Supplier dominated		
VARIABLES	GMR	ROA	EXP	GMR	ROA	EXP	GMR	ROA	EXP	GMR	ROA	EXP
Networking (NET)	-0.00297	-0.0051	0.000289	0.00929*	0.0119***	0.00694	0.00534	0.000910	0.00110	0.00412	-0.000139	0.00844***
	(0.196)	(0.172)	(0.757)	(0.0566)	(0.00248)	(0.104)	(0.245)	(0.839)	(0.842)	(0.145)	(0.945)	(0.00198)
Controls (from table 4)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm's fixed effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations		43,588			130,264			86,016			484,647	
R-squared	0.47	0.055	0.036	0.192	0.016	0.033	0.194	0.001	0.031	0.052	0.002	0.02
Number of firms		7,278			23,069			14,590			85,613	

Robust p-values in parentheses. Standard Errors are clustered at firm level, *** p<0.01, ** p<0.05, * p<0.1. Control variables are the same as reported in columns (4), (8) and (11) of Table 4.

Table 10: Interaction between *strong formal* business networks and industrial clusters/districts

	Firms outside industrial clusters			Firms inside industrial clusters		
VARIABLES	GMR	ROA	EXP	GMR	ROA	EXP
Networking (NET)	0.00609***	0.00118	0.00528*	0.00361	-0.00178	0.00689**
	(0.00502)	(0.574)	(0.0529)	(0.290)	(0.571)	(0.0297)
Controls (from table 4)	yes	yes	yes	yes	yes	yes
Firm's fixed effect	yes	yes	yes	yes	yes	yes
Year fixed effect	yes	yes	yes	yes	yes	yes
Observations	690,473	690,430	690,473	256,525	256,507	256,525
R-squared	0.085	0.002	0.015	0.147	0.037	0.034
Number of firms	125,053	125,051	125,053	42,569	42,569	42,569

Robust p-values in parentheses. Standard Errors are clustered at firm level, *** p<0.01, ** p<0.05, * p<0.1
Control variables are the same as reported in columns (4), (8) and (11) of Table 4.

Table 11: Performance and network diversity in terms of geographical/activity dispersion of partners

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
VARIABLES	GMR	ROA	EXP	GMR	ROA	EXP	GMR	ROA	EXP
Network size	0.00014***	0.00023***	0.00002						
	(0.0072)	(0.000720)	(0.837)						
Sectoral Diversity of members				0.0034	-0.0047*	-0.0038			
				(0.145)	(0.067)	(0.45)			
Sectoral Dispersion of members							-0.0005	-0.0014	-0.014***
							(0.823)	(0.578)	(0.0018)
Controls (from table 8)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year-sector (2 digit)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year-Regions	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations firms-years	21,929	21,927	21,929	21,929	21,927	21,929	21,929	21,927	21,929

Robust p-values in parentheses. Standard Errors are clustered at firm level, *** p<0.01, ** p<0.05, * p<0.1
Control variables are the same as reported in columns (4), (8) and (11) of Table 4. Estimates using OLS method with interaction dummies.

References

Bennedsen M., Nielsen K.M., Perez-Gonzales F. and Wolfenzon D., 2007. Inside the family firm: The role of families in succession decision and performance, *The Quarterly Journal of Economics* 122 (2), 647-691. DOI: 10.1162/qjec.122.2.647

Bentivogli C., Quintiliani F. and Sabbatini D., 2013. *Le reti di imprese, Banca d'Italia* – QEF, n. 152. https://www.bancaditalia.it/pubblicazioni/qef/2013-0152/QEF_152.pdf

Bodnaruk A., Massa M. and Simonov A., 2013. Alliances and corporate governance, *Journal of Financial Economics*, 107: 671–693. DOI: 10.1016/j.jfineco.2012.09.010

Bogliacino F. and Pianta M., 2016. The Pavitt taxonomy revisited. Patterns of innovation in Manufacturing and Services, *Economia Politica: Journal of Analytical and Institutional Economics*, 33(2): 153-180. DOI: 10.1007/s40888-016-0035-1

Brand M. J., Croonen E. P. M. and Leenders R. T. A. J., 2018 "Entrepreneurial networking: a blessing or a curse? Differential effects for low, medium and high performing franchisees", *Small Business Economics*, 50, 783-805. DOI: 10.1007/s11187-017-9895-1

Cai J. and Szeidl A. 2018. Interfirm relationships and business performance, *The Quarterly Journal of Economics*, 133, 3, 1229-1282. DOI: 10.1093/qje/qjx049

Colombo E., Mangolini L. and Foresti G., 2014. *Il quarto osservatorio IntesaSanpaolo-Mediocredito sulle reti d'impresa*, Intesa Sanpaolo - Servizio Studi e Ricerche.

Confindustria, 2016. *Reti d'impresa. L'identikit di chi si aggrega*, Centro Studi Confindustria, Rome.

Confindustria, 2017. *Reti d'impresa. Gli effetti del contratto di rete sulla performance delle imprese*, Centro Studi Confindustria, Rome.

Ferrari C. 2010, The Italian "network contract": a new tool for the growth of enterprises within the framework of the "Small Business Act"? Brief comments on the Italian Law 9 April 2009, n. 33, art.3, co. 4-*ter*. *Columbia Journal of European Law Online*, 16, 77-83.

Goerzen A. and Beamish P.W., 2005. The effect of alliance network diversity on multinational enterprise performance, *Strategic Management Journal*, 26: 333–354. DOI: 10.1002/smj.447

Gulati R. and Higgins M., 2003. Which ties matter when? The contingent effects of interorganizational partnerships on IPO success, *Strategic Management Journal*, 24(2): 127–144. DOI: 10.1002/smj.287

Havnes P. and Senneseth K., 2001. A panel study of firm growth among SMEs in networks, *Small Business Economics*, 16: 293–302. DOI: 10.1023/A:1011100510643

Hoang H. and Antoncic B., 2003. Network-based research in entrepreneurship: a critical review, *Journal of Business Venturing*, 18 (2): 165–187. DOI: 10.1016/S0883-9026(02)00081-2

Huggins R., 2001. Inter-firm network policies and firm performance: evaluating the impact of initiatives in the United Kingdom, *Research Policy*, 30: 443–458. DOI: 10.1016/S0048-7333(00)00092-5

Jack S. L., 2010. Approaches to studying networks: Implications and outcomes, *Journal of Business Venturing*, 25: 120–137. DOI: 10.1016/j.jbusvent.2008.10.010

Koka B. and Prescott J., 2008. Designing alliances networks: the influence of network position, environmental change and strategy on performance, *Strategic Management Journal* 29: 639–661. DOI: 10.1002/smj.679

Lechner C., Dowling, M. and Welpe I., 2006. Firm networks and firm development: The role of the relational mix, *Journal of Business Venturing*, 21: 514–540. DOI: 10.1016/j.jbusvent.2005.02.004

Li H., Corral de Zubielqui, G. and O'Connor A., 2015. Entrepreneurial networking capacity of cluster firms: a social network perspective on how shared resources enhance firm performance, *Small Business Economics*, 45: 523– 41. DOI: 10.1007/s11187-015-9659-8

Lin F. and Lin Y., 2016. The effect of network relationship on the performance of SMEs, *Journal of Business Research*, 69: 1780–1784. DOI: 10.1016/j.jbusres.2015.10.055

OECD (2014). Italy: key issues and policies, *OECD Studies on SMEs and Entrepreneurship*, OECD Publishing. DOI: 10.1787/9789264213951-en.

Mazzola E., Perrone G. and Kamuriwo D., 2016. The interaction between inter-firm and interlocking directorate networks on firm's new product development outcomes, *Journal of Business Research*, 69: 672–682. DOI: 10.1016/j.jbusres.2015.08.033

Nunes S., Lopes R. and Fuller-Love N. (2017). Networking, innovation and firms' performance: Portugal as an illustration, *Journal of The Knowledge Economy*, DOI: 10.1007/s13132-017-0508-7.

Parida V., Patel P., Wincent J. and Kohtamaki M., 2016. Network partner diversity, network capabilities and sales growth in small firms, *Journal of Business Research*, 69 (6): 2113–2117. DOI: 10.1016/j.jbusres.2015.12.017

Park Y., Shin J., and Kim T., 2010. Firm size, age, industrial networking, and growth: A Case of the Korean manufacturing industry, *Small Business Economics,* 35(2): 153–168. DOI: 10.1007/sl 1187-009-9177-7

Parker S., 2008. The economics of formal business network, *Journal of Business Venturing,* 23: 627–640. DOI: 10.1016/j.jbusvent.2008.01.003

Rauch A., Rosenbusch N., Unger J. and Frese M., 2016. The effectiveness of cohesive and diversified networks: A meta-analysis, *Journal of Business Research*, 69, 554-568. DOI: 10.1016/j.jbusres.2015.05.011

Ritala P., 2012. Coopetition strategy – When is it successful? Empirical evidence on innovation and market performance, *British Journal of Management*, 23: 307–324. DOI: 10.1111/j.1467-8551.2011.00741.x

Scagnelli, S.D. and Cisi M., 2015. *Companies' formalized relationships: a study of the effectiveness of italian business Network contracts*, in N. Di Cagno, G. Invernizzi. A. Mechelli, M. Ugolini (eds) Il ruolo dell'azienda nell'economia, Esiste un modello aziendale orientato alla crescita?, 295-307, Il Mulino, Bologna.

Schoonjans B., Van Cauwenberge, P. and Bauwhede H., 2013. Formal business networking and SME growth, *Small Business Economics,* 41: 169–181. DOI 10.1007/sl 1187-01 1-9408-6

Schott T. and Jensen K., 2016. Firms' innovation benefiting from networking and institutional support: A global analysis of national and firm effects, *Research Policy,* 45: 1233 – 1246. DOI: 10.1016/j.respol.2016.03.006

Stoian M.C., Rialp, J. and Dimitratos P., 2017. SME network and international performance: Unveiling the significance of foreign market entry mode, *Journal of Small Business Management* 55(1): 128–148. DOI: 10.1111/jsbm.12241

Tan J., Zhang H. and Wang L. 2015. Network closure or structural hole? The conditioning effects of network-level social capital on innovation performance, *Entrepreneurship Theory and Practice*, 39 (5), 1189-1212. DOI: 10.1111/etap.12102

Vanhaverbeke W., Gilsing, V., Beerkens B., and Duysters G., 2009. The role of alliance network redundancy in the creation of core and non-core technologies: A local action approach, *Journal of Management Studies*, 46: 215–244. DOI: 10.1111/j.1467-6486.2008.00801.x

Watson J., 2011. Networking: gender differences and the association with firm performance, *International Small Business Journal*, 30(5): 536–558. DOI: 10.1177/0266242610384888

Zaheer A. and Bell G., 2005. Benefiting from network position: Firm capabilities, structural holes, and performance, *Strategic Management Journal*, 26(9): 809–825. DOI: 10.1002/smj.