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INTER-FIRM NETWORKS AND FIRM PERFORMANCE: THE CASE OF ITALY

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Inter-Firm Networks and Firm Performance: The Case of Italy.[1]

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Abstract: This study investigates a particular type of network, the inter-firm network (IFN), and its impact on performances of Italian firms between 2010-2015. After revising the literature on alliances and networks for what concerns the geographical and industrial dimension, I focus my attention on networks' performance and innovation propensity. The empirical analysis, based on a sample of about 4,000 firms, is divided in two parts: firstly, applying a "difference-in-difference" technique, is tested the impact of being in an IFN; secondly, focusing on year 2013, are measured the different effects of IFN characteristics. Results demonstrate that belonging to an IFN has a positive impact on firms' growth. Moreover, industry heterogeneity of members and internationalisation scope (rather than innovation) turn out to be the main factors increasing firm's profitability and economic growth.

Keywords: Inter-firm network; Alliances; Performance; Difference-in-Difference; Innovation

JEL classification: C3, L25, P25, R12

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1. Introduction

In the last twenty years, the attention of researchers and experts of many different fields moved from the classical economic scenario of market and hierarchy (Coase, 1937; Williamson, 1991), to a new category in between the two extremes: the hybrid form (Hodgson, 2002; Ménard, 1995; Zenger, 2002). Despite the debate on how hybrids are defined, some authors suggest they correspond to networks or alliances (Powell, 1990). In this paper, embracing both the organization or management literature (Grandori & Soda, 1995; Gulati, 1998; Gulati, Nohria, & Zaheer, 2000) and the economic perspective (Huggins, 1998; Ménard, 2004), one type of hybrids form, i.e. the inter-firm network (IFN), is analysed, in particular for what concerns the Italian scenario. Italy is an interesting case because it has been for a long time the cradle of a different form of networks, the Industrial Districts (IDs) (Becattini, 1990; Dei Ottati, 1994), characterised by geographical proximity of firms and industrial specialisation. These two features allowed the spreading of innovation and knowledge creation between firms in the ID. Instead in IFN, firms do not necessarily belong to the same regions or sectors, but it is however possible to cooperate and to increase firms' innovative capacity. In fact, already existent literature on innovation stresses the advantages of the openness of innovation processes including multiple and different sources of knowledge (Charron, Dijkstra, & Lapuente, 2014; Huggins & Johnston, 2010). However, to date to the best of my knowledge, just very few contributions investigate the importance of IFN networks on firm's economic performance (Gulati, Lavie, & Madhavan, 2011; Lechner & Dowling, 2003; Powell, Koput, & Smith-Doerr, 1996; Stuart, 2000).

Starting from the definition of IFN, and revising the literature on innovation and network characteristics, this paper aims to shed new light on the impact of IFN over firms' economic performance. The empirical analysis takes into consideration a recently ruled network phenomenon in Italy called *Contratto di Rete*, and defined by the Italian law (n. 33/2009) as:

"[…] two or more firms in which the owners share together the same project, or economic activities, aiming to implement their innovative and competitive capacity in the market". This agreement allows the juridical independence and the retention of the individual identity between firms, and it boosts the size of the network allowing firms to compete in the globalized market or to achieve other shared goals, such as innovation. Thanks to these two aspects, this kind of contract may be very useful for Italian firms (mostly small and medium size enterprises) to enhance their competitiveness in a market dominated by large and internationalized companies.

The econometric part is divided in two steps: firstly, I apply a "difference-in-difference" approach to empirically test if Italian firms benefit, in terms of performance differentials, of being a member of an IFN over the period 2010-2015. Secondly, the attention shifts on the determinants of IFN, by investigating the characteristics of firms and networks for the year 2013. Thanks to these two types of analysis, it is possible to have a comprehensive overview of the effects of IFNs in Italy and suggest some *ad hoc* policy interventions. Results show that belonging to an IFN has a positive impact on firms' performance, fostering the need for Italian firms to group together in new form of alliances, different from the traditional ID. The findings on network characteristics point out to the importance of having industry heterogeneity among firms in the network as a repository of diversified knowledge. Finally, is highlighted the positive effect of internationalisation oriented contracts, rather than innovation oriented, for firms' overall performance. These results are interesting for firms and policy maker, because IFNs agreements could constitute a good instrument for small firms to face international trade challenges and foster the diversification of firm's portfolio activities.

The paper is structured as follows: Section 2 investigates the literature behind the concepts of hybrids, IFNs, and innovation; Section 3 describes the methodology used for the data collection and the variable under investigation; in Section 4 are highlighted the main

results; finally, in Section 5 is presented the discussion and conclusions with some suggestions for practitioners and policy makers.

2. Related Literature

Among the scholars studying the networking phenomenon, Ménard (2004) emphasizes the characteristics of IFNs as hybrid organizational forms. In his work, he starts from the literature proposed by Coase (1992) and Williamson (1991, 1996) on the micro-analytical aspects and the trade-off between market and hierarchies. But, why IFNs can be considered as a hybrid form? From an organizational point of view, among the other authors, Grandori and Soda (1995) define the network as a system of relationships, "a mode of organizing economic activities through inter-firm coordination and cooperation" (p. 184). The main variables that characterize a network are: (i) the degree of differentiation between units (both from a negative side linked to the coordination costs, and from a positive side linked to the innovation and complementary resources); (ii) the intensity of inter-firm interdependences (that is in turn affected by asset specificity, uncertainty, resource exchanges); (iii) the number of units to coordinate; (iv) the complexity of interdependent activities; and (v) the asymmetries between resources of different firms in the network, such as knowledge flows and information (Grandori and Soda 1995, p.187). Among different organizational forms are IFN, called also hybrids, because they are considered as organizational arrangements distinct from hierarchies and markets (Ménard, 2012). To make a network operative coordination mechanism and other systems of cooperation have to be applied. Thus, IFNs are structured following resource pooling and relational contracting criteria, which help these networks to face competitive pressure. For what concerns the resource dimension, firms involved in the hybrid share their activities under an inter-firm coordination perspective to generate common rents, without caring for precise bundle definition or individual resource and capabilities endowments. To do so, firms are

involved in relational contracts to be protected from collusive behaviours between firms in the agreement, and to create "transactional reciprocity" (Ménard, 2004). Relational contracts can be considered a good instrument because, in the way they are arranged, they are less influenced from the common problems related to risk and transaction costs, and moreover it is easier to monitor other partners or solve misalignments without renegotiations and fines (Lafontaine & Slade, 2007). Finally, IFN are efficient tools to face competition: firms not only compete in the market under the same agreement, but also compete against each other and with other hybrids for the activities that are not included in the contract. For all these reasons, IFNs have better chances to survive in highly competitive markets and to face the related uncertainties thanks to resource sharing.

Despite the literature on hybrids seems to look at these contracts as a good option to lay between market and hierarchies, Hodgson (2002) states that is better to refer to them as networks or alliances (Powell, 1990). In fact, there is no clear consensus on how hybrids should be defined. Studies on networks and their very different features are unbounded, and IFNs are mostly related to strategic alliances, rather than other types of firms' groups, for two main reasons: first, firms decide to enter an alliance in a voluntary way (Inkpen & Tsang, 2005); secondly, once they take part of an IFN, firms are characterized by horizontal or lateral pattern of exchanges of resources, ideas, and knowledge (Thorelli, 1986). Another relevant characteristic to be considered is the network composition, explained both in terms of industry and size heterogeneity. For what concerns the size aspect, networks can be composed of firms with similar dimensions (i.e. same number of employees or economic performance), or it is possible to identify a leader firm among the members. This latter is the case where a central actor coordinate the other firms, similarly to what happens in some IDs and business groups (Boari, 2001; Cainelli, Iacobucci, & Morganti, 2006; Zaheer & Bell, 2005). Related to industry heterogeneity, following Baudry and Chassagnon (2012), there are vertical or horizontal

networks. The former are organisations where the network is composed by firms of different industries that are along the same value chain, and production coordination is linked to complementary and specialised resources; the latter are related to networks with members of the same sector. As recognised by the literature, is firm's heterogeneity that push firms to get together to increase the inter-sectoral diffusion of advanced knowledge (Álvarez, Marin, & Antonio, 2009; Cassiman & Veugelers, 2002) and combining different overlapping information to achieve better output solutions (Balland, De Vaan, & Boschma, 2013; Hakansson & Lind, 2004). Therefore, different actors with different resources can add value and knowledge to the IFN they belong to, enhancing the probability for firms to increase their productivity and profitability. Also horizontal networks are recognised as a solid network structures: in fact, firms of the same industry increase the production of a particular step in the value chain, or implement research and development activities, for example in R&D oriented contracts (Bentivogli, Quintiliani, & Sabbatini, 2013).

With respect to other organizational forms (such as ID firms and business groups), firms in an IFN do not need the geographical proximity to exchange information and ideas (Álvarez et al., 2009; Mowery, Oxley, & Silverman, 1996). Many scholars already explored the relationship between networking and innovation without taking into account necessarily the geographical dimension of networks (Ahuja, 2000; Dhanaraj & Parkhe, 2006). Following the open innovation paradigm (Chesbrough, 2012), collaborations among firms which are not geographically proximate, are able to transfer complex knowledge across local boundaries, giving raise to high performing networks (Gertler & Levitte, 2005; Huggins & Johnston, 2010). The link between collaboration and network's performance, related to innovation aspects, has been deeply investigated by the literature (Hagedoorn & Schakenraad, 1994). Following the study proposed by Huggins and Johnston (2010) over a sample of knowledge-intensive firms in Northern England, the authors demonstrate that firms are used to set linkages also with actors

of other regions to foster complex knowledge exchanges. These transfers across spatial boundaries, provide a high performing network structure combined with innovation-driven growth. Also Zeng et al. (2010) investigate the relationship between Chinese cooperation network and innovation performance. Focusing on small and medium size enterprises, they found inter-firm cooperation networks, and in particular vertical cooperation (i.e. with different partners), to be positively related with innovation outcomes, thanks to the amount and variety of knowledge shared. The heterogeneity of networks' members has been reported as a relevant characteristic of IFN, as demonstrated by Nieto and Santamaría (2007) for Spanish inter-firm collaborations. Having different partners in the same network increases the possibilities to create new combinations of technologies and knowledge, that in turn affects the degree of innovation and the exploitation of various technological paths. Therefore, open innovation within heterogeneous firms in the network, is a relevant feature to foster firm's performances (Laursen & Salter, 2006).

The IFN, as an example of strategic alliance related to innovation, is not far away from the concept of ID. In this latter, firms operate in the same markets and share geographical proximity (Becattini, Bellandi, & De Propris, 2009; Camuffo & Grandinetti, 2011; Dei Ottati, 2002). Widespread literature on IDs, and other networks rooted in local contexts, supports the idea that knowledge and innovation spread also outside the boundaries of clustered areas. Belussi et al. (2006) document the effect of mixing resources and capabilities inside and outside IDs. The process of exploiting external resources is linked to the absorptive capacity of local firms (Belussi, Pilotti, & Sedita, 2006). For what concerns knowledge transfers, these are possible if actors inside the districts possess the capabilities to absorb knowledge coming from outside the districts, re-elaborate and exploit it inside the cluster. What is important to highlight is not just the development of new process and product with the resources embedded in an area, but also the exploration and exploitation of new knowledge coming from outside the

boundaries. These capabilities turn out to increase firms' competitive advantage in the global scenario, which boosts its productivity and profitability.

Related to other collaborations inside and outside bounded industrial areas, Cainelli et al. (2006) analyse the effects of business groups, as another type of network structure. Business groups are defined as different firms belonging to the same owner (Cainelli et al., 2006), and they originate from the evolution of some industrial districts' firms in leading firms with bigger dimension. The growth of these firms is due to innovation upgrading and product differentiation that characterise the later stages of the firm's evolutionary path. Thanks to these two aspects, business group's firms show a higher profitability and productivity rates.

Another example for what concerns relations inside and outside IDs has been reported by De Marchi et al. (2014) for what they define "district oligopolization". The authors show that as far as globalization is increasing in the last few years, is no more possible to take the district aside the global context, thus the higher is the number of relationships district's firms could have with other actors outside the district, the higher will be the survival threshold in a globalized economy. Again, the geographical proximity and resources embedded in a district are not enough for the prosperity of the district itself, and we could assist to an open up process of the boundaries of networks self-contained in IDs.

Notwithstanding the magnitude of studies related to IFN and innovation performance, to date to the best of my knowledge, just very few contributions explore how IFN have an impact on firm's economic performance. Powell et al. (1996) show how employment growth rate, among other variables, is positively related with the number of alliances firms are involved in. Also sales growth and firm's size are influenced by the IFN, as demonstrated by Stuart (2000) in a longitudinal sample of high-tech alliances in advanced economies. Finally, Lechner and Dowling (2003) highlight the importance of external knowledge and inter-firm interactions to foster firm's economic growth in the information technology cluster in Munich region.

Despite previous studies on networks and innovation, interesting issues concerning the use of IFN and their effects on firm's economic growth remain to be addressed. This paper addresses this gap by testing the following hypotheses:

H1. Belonging to an IFN has a positive effect for firm's performance.

H2a. Innovation-oriented networks positively affect firm's performance.

H2b. Industry heterogeneity among firms in the network positively affects firm's performance.

3. Methodology and Sample

In order to test the three hypotheses, I carried out a quantitative analysis on networking processes of manufacturing and services firms focused on Italy. Italy is a particularly interesting setting due to the large presence of IDs that characterized the economic success of the country at the international level (Becattini et al., 2009; Piore & Sabel, 1984). Moreover, due to the high number of small and medium size enterprises (SMEs), Italian policy makers have encouraged aggregation of firms through a specific Law (n.33/2009) that put at its heart the creation of IFNs. My initial sample comprehends the IFN agreements in Italy from 2010 to 2017. According to the above mention Italian Law, IFNs comprehend independent firms entering arrangements to achieve a common aim or develop new economics activities, through cooperation and coordination. Firms in an IFN agreement commit themselves to: a) collaborate for purposes relevant to those firms (for example open to international markets or developing new products); b) exchange information and industrial/technological services (linking together firms belonging to different sectors); c) share one or more economic activity belonging to each individual process (closer to buyer-supplier relationships). Italian IFNs development is a gradual process, starting from the sharing of a project or by investing the same amount of capital among firms (Tiscini & Martiniello, 2015). The two main positive aspects that characterise an IFN are: (i) the firms that get into the network could benefit from the dimension that the network

reach by being formed of small and medium size firms; (ii) each firm of the agreement could benefit from the organizational flexibility and adaptability to the economic cycle that are typical aspect of small firms.

The main features of Italian IFNs are linked to the variety of industries that are grouped under the same agreement (both agro-food and tourism industry can co-exist under the same contract), to the presence of small dimension enterprises (less than 10 employees), to the participation of at least five firms on average (without any constraints in terms of geographical distance), and to the prevalence of Ltd. Companies (Negrelli & Pacetti, 2016).

According to the industry-classification of firms in each in the agreement, it is possible to distinguish among: vertical networks, where firms belong to different sectors; and horizontal networks, where firms belong to the same industry (Bentivogli et al., 2013).

The dataset used for the analysis comprehends 18,556 firms and 3,697 agreements, collected by the Italian Chamber of Commerce in May 2017. Of these firms, 16,759 are involved in contract without the juridical responsibilities, while the other 3,745 with (see Figure 1 for the evolution of the contracts over the last 8 years). Both for the first group of firms and the second one, the database reports the industry code (following the ATECO 2007 classification[2]), the Province and Region, the date and the number of the firms' establishment contract, the fiscal code for each firm, and the main purpose of the contract.

[INSERT FIGURE 1 ABOUT HERE]

For the empirical analysis, I consider the agreements without juridical responsibility, because, as far as the juridical responsibility requires more time to be implemented because of bureaucratic procedures, there are fewer observations for this type of contract, as reported in Figure 1. From this figure, it is interesting to note that even though they can be considered still

[2] The ATECO 2007 classification is based on the NACE Rev2 classification, proposed by Eurostat and elaborated by the Italian Statistical Institute.

a rare phenomenon with respect to the diffusion of the industrial districts, IFN contracts are spreading over the last 7 years, with an increasing trend despite the recent economic turmoil.

To test the first hypothesis, I use a "Difference-In-Difference" (DID) approach, to understand the impact on firms' performance before and after joining an IFN contract. To do so, I select the firms that sign a contract in 2013, to have financial and performance information for at least two years before and two years after the beginning of the agreement. In year 2013 were signed 589 contracts which involve 2,719 firms in the whole Italian peninsula. After some standard cleaning procedures, the final database on IFNs consists of 2,095 firms, grouped in 529 contracts with a minimum of two and a maximum of 33 firms in each contract.

Financial and performance indices were then extracted from AIDA Bureau van Dijk database, to collect information for each single firm on profits (total turnover, EBITDA-Earnings Before Interest, Taxes, Depreciation and Amortization), relative profitability (ROI- Return on Investments, ROE-Return on Equities, ROA-Return on Assets), size (number of employees), and other indicators related to R&D activities. However, because of the high number of missing data, not all these measures were then adopted for the econometric analysis.

To use the DID approach, are necessary two subsamples of observations: the first one is related to the treated firms, in this case the ones which join an IFN contract in 2013; the second one, the control sample, is represented by the firms that are not involved in this contract. Therefore, I build the second sub-sample, with a stratified random sample selection among all the Italian firms registered in AIDA database. The selection has been made following three criteria: the size of the firms in the treated sample (represented by the number of employees); the industry classification (by ATECO 2007 at two-digit level); and the region at NUTS 2 level (Italian Regions). Respecting these three criteria allows me to have a control sample as close as possible to the treated one, to perform a correct DID analysis (ISTAT, 2017). Also for these firms, I select the same performance indicators as for the treated sample, to have all the information

from 2010 to 2015. The control sample amount on 1,938 observations. Therefore, the final sample of both treated and non-treated firms consists of 4,033 firms.

The DID model is developed over a 5-year panel data (2010-2015), estimated through the following equation:

$$y_{it} = \beta_0 + \beta_1 treat_i + \beta_2 time_t + \beta_3 treat * time_{it} + \beta_4 X_{it} + \alpha_i + \varphi_t + u_{it} \quad (1)$$

where $y_{it}$is the dependent variable measuring the performance of the firms. In our case the selected measures are the turnover growth and EBITDA (both in natural logarithm to flatter the variance); $treat_i$ is a dummy variable taking value 1 if the firm signs a network contract in 2013, 0 otherwise; $time_t$is a dummy variable taking value 1 from the year of the treatment effect (2013), 0 otherwise; and $treat * time_{it}$is the interaction term between treated and time variables. X_{it} is a vector of covariates, which includes the ID membership at firm level, and other dummies to control for firm's size and geographical location. α_i and φ_t are respectively year and industry fixed effects captured using a series of dummies, and u_{it} the error terms. Equation (1) is estimated through a random effect model with GLS estimator (Wooldridge, 2013). Finally, to test if there is also a pre-trend component or a treatment intensity after the firm join these agreements, I estimate also other two equations that constitute a robustness check for the baseline results[3].

To test the second and third hypotheses, i.e. the impact of network determinants on firm's performances, I consider just the treated group, i.e. those firms which belong to an IFN (2,095 observations). Being aware of the possible sample selection bias, in the very first phase of the

[3] The pre-trend equation adds to the three components (*Treat, Time, and Treat*Time*), two other variables measured as an interaction between the treatment dummy and the two separate dummies for the two years before the treatment. In this way, it is clear how was the trend of the treated and control sample before the treatment. The second equation, related to treatment intensity, is composed by the variables *Treat* and *Time*, but in place of the interaction term, there is a variable called treatment intensity, which is an interaction between the post-treatment period and the treat variable, and it measure if the treatment is worth also in the years after it takes place.

analysis has been applied a two-step Heckman selection procedure (Heckman, 1976, 1979). However, the results of the second step estimates are not biased, therefore simple Ordinary Least Squares (OLS) equations have been implemented[4].

The OLS equation is computed as follows:

$$y_i = \beta_0 + \beta_1 X_i + \beta_2 Z_i + \beta_3 \mathrm{K}_i + \delta_i + \theta_j + \varepsilon_{ij} \quad (2)$$

where y_i represents the two dependent variables (EBITDA and turnover) at year 2014, and at year 2015 as a robustness check. X_i is the vector to define network type (Bentivogli et al., 2013):

- *horizontal* if the contract is full horizontal, i.e. all the firms belong to the same ATECO industry at two-digit level;
- partially horizontal (*horizontal mix)* if at least 60% of the firms in the contract belong to the same ATECO industry (this threshold has been computed observing the variability of industry classification for each IFN);
- *vertical* if firms belong to different industries but there are vertical relationships among these firms (see Figure 2).

[INSERT FIGURE 2 ABOUT HERE]

Z_j is the vector controlling for the aim of the contract: for each IFN, there is a column in the database which expresses the purpose firms try to pursue in the agreement. So, I look for the words related to innovation, internationalisation, commercial, and various mix of these, to build a set of dummies to proxy for each different aim (see Figure 3). $K_j$is a vector controlling for other network's characteristics, such as: the structure of the contract (*Network Structure*) computed as the weight average of the network turnover in 2013: if there is a presence of a leader firm in the network (so the turnover is above the weighted average) network structure

[4] The selection variable for the first stage of the Heckman procedure has been computed as a composite social capital index suggested by Cartocci (2007). Previous papers (Antonietti & Cainelli, 2008; Crescenzi, Gagliardi, & Percoco, 2013) applied this index as a reliable measure to proxy for aggregation propensity related to social capital at Province level. Both the results using Heckman procedure and OLS equations are robust and reliable.

take values 1, 0 otherwise (Boari, 2001; Carbonara, 2002); and the ID presence in the network (*Network-ID*) if at least more than 60% of the firms belong at the same time to an industrial district and an IFN (see Figure 4 and 5). $\delta_i$and θ_j are the controls at firm and network level, and industrial and geographical fixed effects, and $\varepsilon_{ij}$is the error term.

[INSERT FIGURE 3 ABOUT HERE]

[INSERT FIGURE 4 ABOUT HERE]

[INSERT FIGURE 5 ABOUT HERE]

Summary statistics and the correlation matrix of the variables are reported in Table 1 and 2, while Table 3 describes the variables of the two models.

[INSERT TABLE 1 ABOUT HERE]

[INSERT TABLE 2 ABOUT HERE]

[INSERT TABLE 3 ABOUT HERE]

4. Results

Results of the DID model are reported in Table 4. The first Column show the results where the dependent variable is the EBITDA. Unfortunately, even if both the Network and Time coefficients are positive and statistically significant, their interaction is still positive but not significant. So being part of an IFN does not have any effect in terms of firm's profitability. For what concerns turnover growth, Column (2), the interaction term is positive and highly statistically significant, meaning that being in an IFN is related to an increase in turnover growth equal to around 14%. This result is in line with the literature and the juridical definition of IFN: in fact, as being grouped in a network, firms can reach bigger dimension, which in turn increase their turnover. To be sure that there are no pre-trend components, in Column (3) I analyse the impact of IFN contracts on firm's turnover adding the pre-trend dummies. As it is easy to note,

the *Network*Time* variable is still positive and highly significant, and the two variables (*Network*2011* and *Network*2012*) are positive and not significant (the significance at 10% level in *Network*2012* is negligible, given that one year before joining a contract a firm could already plan some procedures related to the entrance), concluding that there are no pre-trend behaviours between the treatment and control group. This analysis reinforce the robustness of the baseline model in Column (2). The very interesting result is related to Column (4). In this column is tested the treatment intensity, so the effect of the treatment in the years after its application. The *Treatment Intensity* variable is positive and highly statistically significant, meaning that firms which join an IFN could reach a turnover growth of 6% in the two years after their entry. Even though the time span of the post-treatment period is not so long, it is worth nothing that the effect lasts also over time and it is a good incentive for firms which decide to choose this kind of network agreement.

It is possible to conclude the first part of the analysis partially supports the first hypothesis: joining an IFN has a positive effect on firm's performance, even though results are relevant for what concerns firm's economic growth but not its profitability.

[INSERT TABLE 4 ABOUT HERE]

Hypotheses 2a and 2b are tested with OLS regression in Table 5. In Column (1) and (2) are reported the results for the two dependent variables computed at time *t* (2014), while in Column (3) and (4) the results referred to the year 2015, so *t+1* period. Starting from the EBITDA variable in column (1), estimates show that the intermediate form of industry heterogeneity (*horizontal mix*) positively impacts firm's profitability (with respect to baseline category *vertical* type of networks, so totally heterogeneous firms in the agreement). This result is valid not only in terms of profitability, but also for what concerns firm's growth, as reported in Column (2). Moreover, these coefficients are also robust taking into consideration one-year lead variables. Therefore is preferable for firms belonging to heterogeneous networks, rather

than fully specialised ones; this is probably due to the possibility for firms in such agreements to expand and reinforce their value chain activities, without losing the individual firm's specialisation (Carbonara, Giannoccaro, & Pontrandolfo, 2002; Dyer, 1997; Jarillo, 1988).

But the very surprisingly result of the second part of the analyses is related to the aim of the IFN. In fact, in all the four columns is internationalisation orientation that has a positive impact over the different performances, rather than innovation purpose. This could be explained in very different ways: firstly, innovation projects have a long-term horizon, so given the nature of the dependent variables, they are able to measure profitability and revenues just in the short-term, without having data of longer time span; collect the magnitude of innovation; secondly, the proxy for innovation is probably too weak to measure this aim, and a good implementation could be to add R&D expenditure at firm level or other indicators, such as number of patents or collaboration with research centres to control for innovation activities. Despite this, looking at the internationalisation oriented networks, the results are supported by previous studies, in fact internationalisation is achievable with an increase in the size of the firm, and this is one of the major aim of the IFN (Hsu, Lien, & Chen, 2015; Johanson & Vahlne, 1977; Sui & Baum, 2014). Moreover, internationalisation could be linked also to diversified strategies to achieve foreign markets, and this finding is reinforced by industry heterogeneity of firms in the network (Batsakis & Mohr, 2017; Lu & Beamish, 2004). Therefore, hypothesis 2a is not confirmed within the innovation objective, while it turns out that internationalisation-oriented networks have a better impact on firm's performance both in terms of profitability and growth. Hypothesis 2b is confirmed, supporting previous studies where industry heterogeneity is considered helpful for the growth of firms in a network (Goerzen & Beamish, 2005; Hawawini, Subramanian, & Verdin, 2003). Unfortunately nothing could be added for the remaining variables, for example *Network Structure* is negative and significant just for some model

specifications, therefore this results is not robust enough to drive conclusion about the effect of having a leader firm in the network and firm's overall performance.

[INSERT TABLE 5 ABOUT HERE]

5. Discussion and Conclusions

This paper provides some empirical evidence on a new network contract that took place in Italy from 2009. The novelty of the IFN is to allow firms that are not geographically proximate to cooperate and develop specific economic projects. Among the benefits of an IFN contracts, is the share of new ideas and the acquisition of knowledge among partners, both from the same or different industries. The aim of this study was to shed some light on these new form of alliances, and to better understand if it is worth for firms, in terms of performance, to aggregate under these contracts. Moreover, if this was the case, which are the elements of the network that influence the profits of the firms.

The results of the "difference-in-difference" approach show that an IFN agreement has a positive impact on firm performance, in terms of economic growth, while the profitability aspect is not supported by the empirical evidence. This finding is in line with one of the benefits of IFN, that is reaching bigger size typical of large companies, without losing the flexibility and adaptability of small and medium firms. Moreover, has been demonstrated that the effect of these agreements lasts also for the period after the entrance, promoting IFN as a valid instrument for firm's growth.

For what concerns the analysis of the characteristics of an IFN, and the role of innovation, results are not in line with the presented literature. In fact, while contract with innovation as first aim seems to do not play a role over firms' performance, internationalisation oriented contracts positively affect profitability both in terms of turnover and EBITDA. This result is interesting, also from a policy perspective, because small firms, such as the one involved in

IFNs, achieve the possibility to open up to international markets. Moreover, the internationalisation aspect is also supported by the diversification of the value chain activities, and the heterogeneity of firms participating in the network.

The major policy implications about the creation of IFN are connected to the financial incentives firms can afford getting together with these agreements. In fact, as far as internationalisation processes and new product development require high amount of capital and resources, it could be easier for firms to obtain funds through IFN contracts. Furthermore, policy makers should be aware that IFN contracts could be a vehicle to foster not only regional economic growth for neighbourhood regions, but also inter-regional growth, increasing the knowledge transfers and social capital among collaboration and cooperation practices (Fitjar & Rodríguez-Pose, 2015; Huggings, 2001).

This work is not free of limitations. The study is based on year 2013. I would like to consider also other years, to understand if the results are robust also for different periods. Moreover, by having more years concerning the balance sheet data, it allows to extend the post-treatment effect in the difference-in-difference analysis, and therefore to understand if these contracts are worth in a long-time span. The control sample has been set through an *ad hoc* procedure: I might be able to refine it by using a propensity score matching technique. Finally, it might be important to test the results obtained in this paper on contracts with juridical responsibility, to understand if the level of juridical formalisation plays a role for this type of alliances.

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Tables and Figures

Table 1: Summary statistics: a) complete sample and b) treatment sample

a)

Variable	Mean	Std. Dev.	Min.	Max.	N
Turnover14	6393.671	29291.875	0	690588.625	3899
EBITDA14	412.834	2086.608	-19134.854	47281.406	3879
Network Type	0.304	0.669	0	2	4037
Network Aim	1.593	2.226	0	7	4037
Network Structure	0.385	0.487	0	1	4037
Network ID	0.137	0.344	0	1	4037
District	0.295	0.456	0	1	4011
Network Size	6.313	6.233	2	33	2095
Firm's Age	2.366	1.021	0	4.771	3796
Firm's Size	31.79	118.434	0	3292	3793
North-West	0.29	0.454	0	1	4037
North-East	0.26	0.438	0	1	4037
Centre	0.205	0.404	0	1	4037
South	0.245	0.43	0	1	4037

b)

Variable	Mean	Std. Dev.	Min.	Max.	N
Turnover14	7097.706	31597.75	0	645793	1961
EBITDA14	428.339	2109.539	-19134.854	47281.406	1947
Network Type	0.586	0.835	0	2	2095
Network Aim	3.069	2.24	0	7	2095
Network Structure	0.741	0.438	0	1	2095
Network ID	0.265	0.441	0	1	2095
District	0.308	0.462	0	1	2085
Network Size	6.313	6.233	2	33	2095
Firm's Age	2.391	1.011	0	4.727	2033
Firm's Size	34.331	134.425	0	3292	1994
North-West	0.29	0.454	0	1	2095
North-East	0.258	0.438	0	1	2095
Centre	0.207	0.405	0	1	2095
South	0.245	0.43	0	1	2095

Table 2: Correlation matrix: a) complete sample and b) treatment sample

a)

Variables	Turnover14	EBITDA14	Network Type	Network Aim	Network Structure	Network ID	District	Network Size	Firm's Age	Firm's Size	North-West	North-East	Centre	South
Turnover14	1.000													
EBITDA14	0.684	1.000												
Network Type	0.026	0.020	1.000											
Network Aim	0.023	0.005	0.275	1.000										
Network Structure	0.030	0.015	0.430	0.550	1.000									
Network ID	-0.001	0.019	0.181	0.246	0.286	1.000								
District	0.004	0.008	0.011	0.012	0.009	0.493	1.000							
Network Size	0.029	0.019	-0.007	0.195	0.259	-0.085	-0.065	1.000						
Firm's Age	0.135	0.126	0.057	0.006	0.048	0.030	0.076	0.108	1.000					
Firm's Size	0.614	0.447	0.023	0.024	0.047	0.010	0.016	0.015	0.137	1.000				
North-West	0.023	0.014	-0.025	-0.073	-0.024	0.081	0.108	-0.187	0.037	-0.012	1.000			
North-East	0.015	0.022	0.039	-0.027	0.051	0.057	0.091	0.111	0.070	0.025	-0.378	1.000		
Centre	0.018	0.007	-0.010	0.015	-0.014	-0.010	-0.011	0.118	-0.018	0.052	-0.324	-0.301	1.000	
South	-0.057	-0.043	-0.004	0.089	-0.013	-0.134	-0.197	-0.028	-0.095	-0.062	-0.365	-0.338	-0.290	1.000

b)

Variables	Turnover14	EBITDA14	Network Type	Network Aim	Network Structure	Network ID	District	Network Size	Firm's Age	Firm's Size	North-West	North-East	Centre	South
Turnover14	1.000													
EBITDA14	0.678	1.000												
Network Type	0.023	0.027	1.000											
Network Aim	0.010	-0.000	-0.041	1.000										
Network Structure	0.024	0.021	0.166	0.055	1.000									
Network ID	-0.014	0.025	0.015	-0.028	-0.011	1.000								
District	0.025	0.042	-0.004	-0.018	-0.029	0.715	1.000							
Network Size	0.029	0.019	-0.007	0.195	0.259	-0.085	-0.065	1.000						
Firm's Age	0.140	0.119	0.071	-0.022	0.060	0.030	0.065	0.108	1.000					
Firm's Size	0.713	0.451	0.018	0.014	0.055	0.002	0.028	0.015	0.134	1.000				
North-West	0.014	0.021	-0.038	-0.138	-0.050	0.122	0.117	-0.187	0.003	-0.012	1.000			
North-East	0.024	0.029	0.063	-0.047	0.114	0.088	0.110	0.111	0.098	0.035	-0.377	1.000		
Centre	0.016	-0.013	-0.019	0.022	-0.040	-0.019	-0.021	0.118	-0.018	0.037	-0.326	-0.302	1.000	
South	-0.054	-0.040	-0.006	0.173	-0.026	-0.201	-0.216	-0.028	-0.086	-0.058	-0.364	-0.336	-0.291	1.000

Table 3: Variables description.

Variables	Measure	Type
Dependent Variables		
EBITDA	Earnings Before Interest, Taxes, Depreciation and Amortization. Model 1: Natural logarithm of EBITDA Model 2: Natural logarithm of EBITDA for years 2014 and 2015	Continuous
Turnover	Model 1: Turnover growth rate in natural logarithm Model 2: Turnover in natural logarithm for years 2014 and 2015.	Continuous
Independent Variables		
Network	=1 if the firm belong to an IFN, 0 otherwise	Dichotomous
Time	=1 if the year is from 2013 to 2015, 0 otherwise	Dichotomous
Network*Time	=1 if a firm has an IFN from year 2013, 0 otherwise	Dichotomous
Network*2012	=1 if "Network" =1 and Year=2012, 0 otherwise	Dichotomous
Network*2011	=1 if "Network" =1 and Year=2011, 0 otherwise	Dichotomous
Treatment Intensity	=1 if year=2013 and Network=1 =2 if year=2014 and Network=1 =3 if year=2015 and Network=1	Continuous (0-3)
Network Type	Definition of network specialisation degree according to firm's industry: - horizontal=1 if 100% of the firms in a network have the same industry code (fully specialised); -horizontal mix=1 if 60% of the firms in a network have the same industry code (partially specialised); -vertical=1 if firms in the network have different industry codes (diversified)	Dichotomous
Network Aim	Definition of network purposes: -innovation; -internationalisation; -commercial; -innovation and internationalisation; -innovation and commercial; -internationalisation and commercial; -innovation, internationalisation and commercial.	Dichotomous
Network Structure	=1 if the network has a leader firm, 0 otherwise	Dichotomous
Network ID	=1 if a network has more than 60% of the firms that belong also to an Industrial District	Dichotomous
Control Variables		
District	=1 if a firm belongs to an industrial district (following ISTAT classification, 2001), 0 otherwise	Dichotomous
Network Size	Number of firms for each network	Continuous
Firm's Size	Number of employees in each firm	Continuous
Firm's Age	Natural logarithm of firm age (2013–foundation year)	
Geographic location	Classification at NUTS1 level: -North-West; -North-East; -Centre; -South and Islands.	Dichotomous

Table 4: Difference-in-Difference estimates

VARIABLES	(1) EBITDA	(2) Growth	(3) Growth Pre-trend	(4) Growth Treat. Int.
Network*Time	0.044	0.138***	0.231***	
	[1.53]	[2.68]	[3.02]	
Treatment Intensity				0.058***
				[2.68]
Network	0.281***	0.233***	0.139*	0.244***
	[5.46]	[4.11]	[1.75]	[4.42]
Time	0.166***	-2.028***	-2.081***	-2.047***
	[5.50]	[-38.16]	[-33.26]	[-35.64]
Network * 2011			0.051	
			[0.60]	
Network * 2012			0.207*	
			[2.13]	
District	-0.057	-0.077	-0.077	-0.077
	[-1.07]	[-1.44]	[-1.44]	[-1.43]
Size	0.005***	0.005***	0.005***	0.005***
	[5.78]	[6.37]	[6.36]	[6.37]
North-West	0.556***	0.480***	0.479***	0.480***
	[7.68]	[6.59]	[6.59]	[6.59]
North-East	0.402***	0.210***	0.209***	0.210***
	[5.39]	[2.76]	[2.75]	[2.76]
Centre	0.284***	0.263***	0.262***	0.263***
	[3.45]	[3.17]	[3.17]	[3.17]
Constant	3.063***	6.106***	6.170***	6.100***
	[9.47]	[9.40]	[9.46]	[9.40]
Observations	17,584	10,769	10,769	10,769
R-squared	0.0149	0.213	0.213	0.213
Number of ID	3,833	3,752	3,752	3,752
Industry FE	YES	YES	YES	YES
Year FE	YES	YES	YES	YES

t-statistics in parentheses, *** p<0.01, ** p<0.05, * p<0.10

Clustered standard errors at ID level

Table 5: Network determinants estimates.

VARIABLES	(1) EBITDA t	(2) Turnover t	(3) EBITDA t+1	(4) Turnover t+1
Network Type				
Horizontal	0.003	0.102	-0.059	0.103
	[0.03]	[0.98]	[-0.54]	[0.94]
Horizontal mix	0.261**	0.300***	0.289***	0.252**
	[2.52]	[2.94]	[2.76]	[2.38]
Network Aim				
Innovation	0.136	0.039	0.096	0.116
	[0.97]	[0.32]	[0.71]	[0.87]
Internationalisation	0.350**	0.347**	0.306*	0.454***
	[2.08]	[2.31]	[1.82]	[2.81]
Commercial	0.355*	0.098	0.284	0.056
	[1.69]	[0.48]	[1.30]	[0.24]
Inn+Internat	0.042	0.044	-0.007	0.028
	[0.27]	[0.33]	[-0.05]	[0.19]
Inn+Comm	0.248	0.155	0.203	0.263*
	[1.58]	[1.09]	[1.29]	[1.73]
Int+Comm	0.230	0.084	0.105	0.111
	[1.00]	[0.38]	[0.44]	[0.46]
Inn+Int+Comm	0.107	0.042	0.005	0.188
	[0.61]	[0.26]	[0.03]	[1.11]
Network Structure	-0.105	-0.154*	-0.196**	-0.121
	[-1.07]	[-1.72]	[-2.00]	[-1.24]
Network ID	-0.179	-0.130	-0.052	-0.051
	[-1.55]	[-1.11]	[-0.41]	[-0.41]
District	0.325***	0.194*	0.120	0.067
	[2.98]	[1.72]	[0.97]	[0.55]
Network Size	0.002	0.017**	0.004	0.021***
	[0.27]	[2.33]	[0.54]	[2.82]
Firm's Age	0.632***	0.664***	0.568***	0.639***
	[14.04]	[14.96]	[12.12]	[13.47]
Firm's Size	0.004***	0.004***	0.004***	0.004***
	[3.76]	[4.11]	[3.33]	[3.94]
Constant	2.613***	4.343***	2.999***	4.380***
	[7.75]	[10.68]	[8.61]	[9.84]
Observations	1,564	1,813	1,497	1,708
R-squared	0.267	0.301	0.239	0.284
Industry FE	YES	YES	YES	YES
Geographical FE_NUTS2	YES	YES	YES	YES

t-statistics in parentheses, *** p<0.01, ** p<0.05, * p<0.10

Standard errors clustered at firm level

Figure 1: Evolution of Italian IFNs.

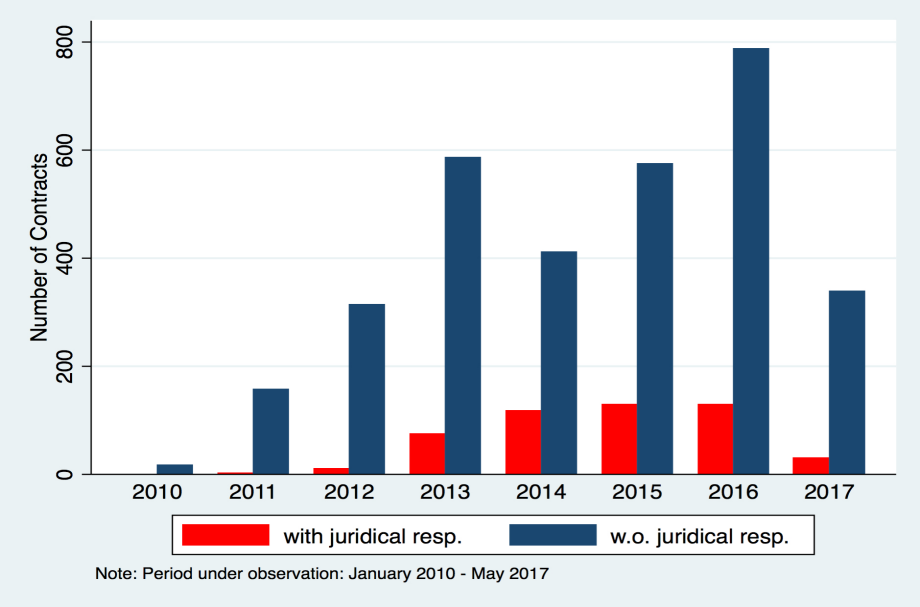

Figure 2: Distribution of IFNs according to the type of the network.

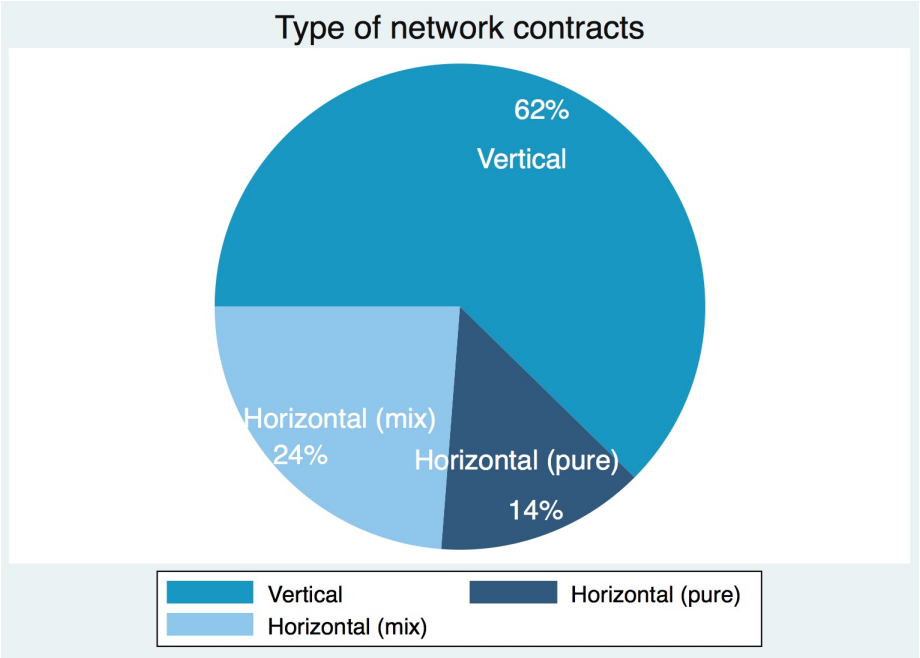

Figure 3: Distribution of IFNs according to the aim of the network.

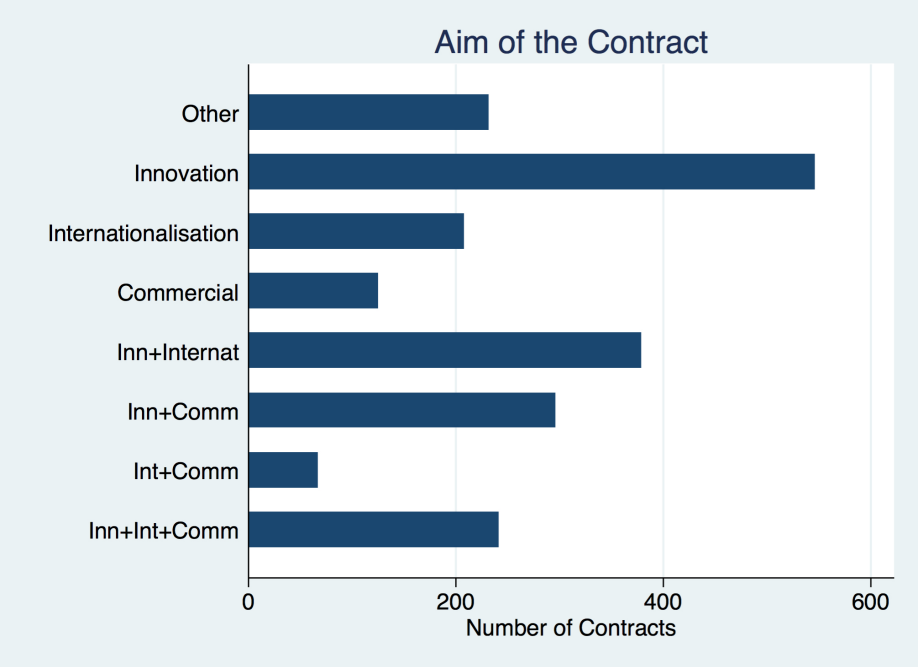

Figure 4: Distribution of IFNs according to the aim of the network.

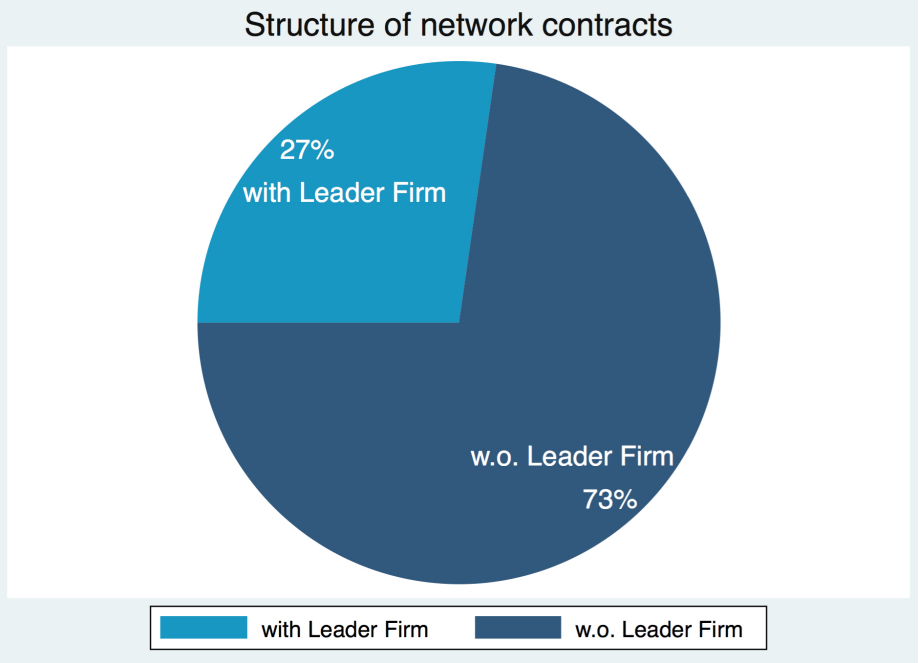

Figure 5: Presence of ID firms within the network boundaries.