



# Triggering cooperation among firms: an empirical assessment of the Italian Network Contract Law

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## Abstract

In this paper, we empirically investigate if and how the Italian Law on Network Contracts was able to trigger the establishment of networks among the involved firms. This law defined network contracts as agreements among firms to cooperate in order to improve, both individually and collectively, their innovative capacity and competitiveness in the market. It promoted them in virtually all Italian regions. During the year 2012, 213 network contracts were signed involving a total of 1083 firms. The empirical analysis shows that network contracts provide an answer to the various needs that the firms involved, if acting as single entities, cannot tackle. Indeed, on the one side, when firms that signed a network contract were characterised by mixed types of ownerships regimes, this fact negatively affected the performance of the firms involved although they ranked in the top positions in terms of correspondence with the aims of the law. The opposite holds when we consider firms within network contracts characterised by the presence of joint shareholding: this shows that despite a positive impact on performance, these networks are not specifically targeted by the law.

**Keywords** Contract law · Italy · Theory of the firm

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## 1 Introduction

Networks of inter-firm relationships are crucial elements for firms' survival and growth (Lechner and Dowling 2003; Huggins and Johnston 2010; Eigenhüller et al. 2015). Firms devise strategies to benefit from the complementarities between internal and external processes of search aimed at increasing the organization's knowledge (Cassiman and Veugelers 2006). This turns out to be important also for firms within clusters, where connectedness can further boost performance (Lechner and Leyronas 2012). Firms can design quite different forms of collaboration, characterised by various degrees of formalization, ranging from loose networks or trade associations, to franchising or joint ventures. These forms of 'co-opetition' (Brandenburger and Nalebuff 1996) are traditionally put in place through spontaneous forms of collaboration. In the more recent experience, the aggregation of firms has often been fostered by a set of economic and financial incentives that are introduced by the policy makers at national and, more often, at the local level.

A very interesting case, in this respect, is the Italian Law on Network Contracts (NCL) that was issued at the beginning of 2009 (Law 33/2009) and updated in 2012 (Law 134/2012). It defined Network Contracts (NCs) as "agreements among firms to cooperate to improve, both individually and collectively, their innovative capacity and competitiveness" and promoted the signing of NCs in all Italian regions. The law is an interesting one, as it aims not to oblige firms to comply with some principle, but it is a tool to promote the building of firms' networks. Thus, it is a trigger rather than a benchmark.<sup>1</sup>

Since it was issued in 2009, until the mid-2013, the NCL has triggered the signature of 748 contracts involving a total of 3964 firms. 48% of the contracts comprised more than 4 and less than 9 firms. Two-third of the firms were limited liability companies. The territorial distribution of the contracts was limited to one province in 41% of the cases, to two provinces in the 32%, while the rest extended over three or more provinces. The vast majority of contracts (74%) was within one region. Both contracts and firms show similar patterns regarding the territorial breakdown between North–East, North–West, Centre and South of Italy. While the former two show similar percentages of both (around 30%), Centre shows 22% of contracts and 26% of firms, finally the South shows 16% of contracts and 18% of firms. The majority of contracts are in manufacturing. Metal working, (green) building, retail, informatics, personal and household goods are the most represented sectors.

Moreover, although they are not explicitly specified in the NCL, we reckon that some crucial elements should be underlined in any analysis of the NCL, related to the peculiar nature of the Italian industrial structure. The first relates to

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<sup>1</sup> The historical experience shows that Industrial Districts (IDs) have been capable to overcome such limits, as SMEs in IDs can compensate the absence of internal economies of scale by recurring to external economies (Cainelli and Leoncini 1999) acquired through market and non-market transactions.

the particular Italian industrial structure. Indeed, as it has been proposed, the Law offers important triggers especially to the vast majority of Italian SMEs.

“The potential usefulness of the NCs Law is immediately clear once the Italian industrial structure is considered. In fact, as it is almost entirely made of SMEs in traditional manufacturing sectors, one of the main problem of the Italian economy appears to be how to overcome the lack of economies of scale in production and innovation. The Italian network contract represents the normative answer to the need perceived by Italian SMEs to formalize network organizations in order to be accountable for their collective activities with respect to both the state and their clients.” (Moretti 2017, p. 60)

The second relates to the North–South divide that characterises the Italian industry. In this case, besides the analysis of the geographical differences between firms, we are also interested in understanding if social capital has a complementary or a substitute role with respect to NCs. Indeed, in the case of Industrial Districts (IDs), the many transactions that SMEs must face are affordable, in terms of uncertainty and opportunism, because firms within IDs typically benefit from the intangible public good constituted by the social capital (Antonietti et al. 2014; Bürker and Minerva 2014; Laursen et al. 2012). However, as IDs experience has been geographically limited, a debate developed on which are the main characteristics and policies for local development that could usefully be replicated in other geographic/economic contexts (Becattini 2002).

Our interest in evaluating NCs comes from these premises. Indeed, NCs seem to constitute an instrument capable to make-up for these missing elements of local development. Moreover, in spite of the huge number of contracts signed, an assessment of their results is surprisingly missing as, to our knowledge, no systematic attempt at evaluating the results of NCL and, more importantly, at linking the NCL to the literature on local development, has been produced so far. As the law is not binding, but aims to promote networks, we are interested in evaluating if and how NCL was able to induce firms to build genuine networks to exchange knowledge and other inputs.

We will thus perform an empirical analysis of the 213 contracts signed in 2012 among 1083 firms to provide an evaluation of their outcome, and to verify whether the law was successful in triggering networks of firms. The chosen year (2012) is deemed sufficiently far from the introduction of the law (2009), in order to evaluate its impact, and it is immediately antecedent to the generation of the effects of the major updating of the Law that took place in 2012. In particular, we will focus on the implementation of the NCL by checking whether NCs can be of any use in areas where social capital is low (i.e. in the South of Italy): NCs are helpful if they can provide firms with a favourable environment they could not get otherwise.

At this regard, we are interested in several features that will be empirically tested by means of both multi criteria and econometric analysis. Therefore, the research questions of this paper are the following: (1) whether NCL was successful in triggering collaboration among participant firms; (2) whether and how NCs

can be useful in areas characterised by low levels of social capital; (3) whether NCs were useful instruments to address the industrial North/South divide.

The paper is structured as follows. Section 2 provides the theoretical background. Section 3 introduces the dataset and discusses the main results of the empirical analysis. Section 4 draws some conclusions.

## 2 Network contracts

### 2.1 Theoretical background

It is since the seminal contribution by Coase (1937) on the nature of the firm that the “institutional structure of production” (Coase 1992) has been under scrutiny to analyse the ‘space’ of organisational forms between the two polar cases of market and hierarchy. Since then, the make-or-buy debate, that is the dichotomous view that sees market and hierarchies as separate entities where the existence of one forbids the existence of the other, or to use Richardson’s words firms are “islands of planned co-ordination in a sea of market relations” (Richardson 1972, p. 883), has absorbed much of the efforts. In parallel, mixed modes of production, combining competition and cooperation have gained ground in the literature,<sup>2</sup> or, to use Richardson words again, “the dense network of co-operation and affiliation by which firms are inter-related” (Richardson 1972, p. 883).

In a series of publications, Menard (2004, 2006, 2012) has extensively described these forms of organizations, that he termed hybrids.<sup>3</sup> Hybrids are defined as “arrangements in which two or more partners pool strategic decision rights as well as property rights, while simultaneously keeping distinct ownership over key assets” (Menard 2012, p. 2). The variety of arrangements of hybrid organizations encompasses types such as supply chains, franchises, joint ventures, partnerships etc. They are all characterized by a non-standard mode of organization that refers neither to the pure market, nor to the pure hierarchy.

In this way, through the adoption of hybrid organizations it is possible to maintain a proper alignment of transactions with the governance structure. The hybrid organization in these cases works as the other types of organizations in that it allows to modify the various arrangements that are not coherent with the transaction involved and thus the resulting modification will produce either a reduction in costs or an increase in efficiency (models are proposed for instance in Baker et al. 2002; 2008). Complementarities, joint production and extraction of value from knowledge are thus fundamental elements that favour intermediate forms of organization between

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<sup>2</sup> Although it is out of the scope of this paper, it is worth mentioning that one important stream of literature has provided thorough insights on make-and-buy (or concurrent sourcing). See Parmigiani 2007, Parmigiani and Mitchell 2009 and Antonietti et al., 2014 for the Italian case.

<sup>3</sup> Menard (2011) refers the term hybrid to the Coase/Williamson tradition, while in management theory (e.g. Baker et al, 2008, Grandori and Soda 1995) and sociology (e.g. Thorell, 1986) terms such as networks and/or alliances are more often found. Surveys on hybrid organizations can be found in Menard (2011), Jolink and Niesten (2012), Niesten and Jolink (2015).

market and hierarchy, as they allow for a strategic use of the idiosyncratic input (the available knowledge) with respect to the partners with which they entertain cooperative agreements.

We will thus quantitatively evaluate our first working hypothesis: if and how NCs were used by Italian firms to build networks and if these networks were functional to address some of the weaknesses of the Italian industrial structure, such as, for example, the pooling of resources and the building of stable client/supplier relationships.

Furthermore, both theoretical and empirical literature tend to emphasize how networks of firms tend to show better levels of performance than firms operating in isolation (Marshall 1920). The ratio being that firms within networks benefit from the presence of external economies at the local level (Glaeser et al. 1992; Henderson et al. 1995; Cainelli and Leoncini 1999, for the Italian case).

However, geographic proximity by itself is not a sufficient condition to engender the forms of learning necessary to create external economies, and thus different forms of proximity need to be put into the mix. Firms within networks would benefit, on the one side, from close sectoral links, but also, on the other side, from geographical and relational proximity. Organised networks of clusters can benefit from the structure of their combined local economic and cultural/social activities, which manifest in both traded (e.g. through market mediated relationships) and untraded linkages. This is what in economic sociology has been termed social-embeddedness (Granovetter 1985). Indeed, economic activities that are, as is frequently the case for Italy, spatially localized, can be described as economies that, being socially embedded, are based as much on social relationships, such as friendship and kinship, as on techno-economic ones. Hence, there is evidence supporting the fact that social interactions facilitate knowledge transfer (Inkpen and Tsang 2005).

This ‘network paradigm’ seems to suggest that locally formed networks are typically associated with mutual trust, as a way to manage economic relations beyond the dual structure of market and hierarchy highlighted above. The most typical case being that of sharing tacit knowledge among network agents. Thus, one of the key elements that have been identified as a creator of added value in network processes is social capital. The presence of trust has been explained by the presence of mutual bonds linking the agents within a network.

Within such an environment, the existence of external economies is typically allowed by the presence of trust between the agents that allows to reduce (or even to eliminate) opportunism and uncertainty in market transactions. Trust in turn is based on the endowment of social capital in the civil society (see for instance, Knack and Keefer 1997; Zak and Knack 2001; Akçomaka and ter Weel 2009).

Social capital is about the value of social networks, bonding similar people and bridging between diverse people, with norms of reciprocity. Social capital is not an entity in itself. It is produced by several elements with the common characteristics of incorporating certain aspects of the social structure, and of facilitating certain individual actions. Following Putnam (1993), social capital refers to features of social organization, such as trust, norms, and networks, that can improve the efficiency of society by facilitating coordinated actions.

We will thus address our second hypothesis: whether the role of social capital was complementary or substitute in network relationships.

Finally, the role of social capital has been often used to characterise how the Italian regional structure of its industry was developed (Putnam 1993). Indeed, as many analyses have conclusively shown, the Italian North–South divide has its roots in the wide differences in social capital endowment (see, for instance, de Blasio and Nuzzo 2009; Mauro and Pigliaru 2011; Bürker and Minerva 2014). Regions with a low level of social capital have historically shown lower technical and economic performances with respect to the regions with a high endowment of social capital.

We will address our third and final hypothesis: if NCs were used in the South of Italy in order to try to put in motion those forces that the North of Italy was able to develop endogenously.

In order to test the three abovementioned hypotheses, we have chosen to perform both a multicriteria and an econometric analysis. The conjoint adoption of these two methodologies allowed us to check the robustness of results and to compare the degree of adherence to the NCL and the competitiveness of involved firms. The use of only one methodology would not have allowed us to carry out a sound analysis of all the hypotheses of the paper.

## 2.2 Aims of the Law on Network Contracts

The main characteristic of a network contract is the presence of a common purpose among its participants to achieve growth of innovative capacity and increase of competitiveness. However, for the contract to be valid, it only needs to pursue one of these two objectives. In this respect, the increase of the innovative capacity is intended in general terms as the possibility that the company—precisely because it is part of a network—can either access new technological opportunities or develop its own.

In general terms, the network contract may be considered as a multilateral contract with a common purpose, to organise peculiar activities. The contract must explicitly state the activities that constitute the fundamental baseline and the necessary reference for the development of the relationships among participating firms. It is envisaged that these activities are those that would be too expensive or just difficult to perform by each affiliated firm on its own, as in the case of: (a) research, (b) marketing of products in foreign market, (c) professional services such as accounting and tax, legal, or financial management. It also states the way in which rules among firms are issued, integrated and implemented to achieve the common program that can be modified and enriched along the life of the network. NC also establishes a legal representative that replaces the firms in a series of procedures (for instance, with the public administration or with banks).

This new tool, because of its flexibility, can give rise to a wide range of collaborative projects and increase the quantity and quality of the projects of business collaboration to achieve goals that could not be reached individually. In this respect, the new relationships may increase the demand for the goods and/or services produced by the firm. Networks should also allow to enhance the know-how of the companies involved in terms of both innovation and improvement of the quality of the products. This should lead to a higher market competitiveness of enterprises, by improving

access to national and international markets to small and medium firms. Moreover, the creation of synergies is a mean to face the economic crisis through the coordination of a wide range of activities from production to service delivery or logistics management. In the case of horizontal networks, the joint activities should be related to the realisation of integrated offer of products and/or services, joint promotion of these products/services, common R&D investments, sharing of customers or suppliers. For vertical networks, the aim should consist in more efficient governance of the supply chain.

In this context, NCL has been proposed as a potentially useful tool, offering to firms outside the narrow boundaries of geographical and sectoral specialisation a way to establish formalised links with firms belonging to different regions and sectors. NCs could thus be of help for firms willing to enlarge their geographical or sectoral reach: firms willing to establish virtuous links, but that in general cannot benefit from the district environment to build them. Moreover, NCs allow to establish relationships and linkages that could otherwise be restricted to regions with high social capital. Regions with low levels of social capital can give rise to higher performance levels that determine catch-up dynamics with respect to more efficient areas.

The main features of NCs are flexibility, lower operating costs and knowledge exchange. In an environment, such as the Italian one, where there already existed non-formalized networks and embryonic forms of collaboration, through the issue of the network contract law the legislator intended to provide a framework that could fill the gaps left by the self-organization of the parties, helping them to set in a clear way their rights and duties within the network. From this point of view, NCs could be considered as elements to reduce both information asymmetry within firm cooperation agreements. However, although NCs are tools to facilitate cooperation, they do not forbid free riding, and for this reason, social assets are needed, especially within clusters of firms (e.g. Brusco 1982; Becattini 2002; Cantner et al. 2010; Nunes and Lopes 2015). Indeed, firms that are partners in a NC are free to decide their level of commitment and thus of cooperation, as the purpose of the NC is not to fix terms and conditions (like a real contract) to the production of the network's outcome. Moreover, there are not formal sanctions for misbehaviour and for walking away once the burden is reputed too high. Thus, we reckon that the notion of social capital still maintains an important role in the definition and the working of NCs.

Network contracts allow firms to establish economic and strategic linkages with other firms operating in different sectors and with different positions in the value chain. These linkages emerge given the benefits that all firms belonging to a network can experience from the exchange of information, procedures and innovation activities. These relationships give firms with lower technical and economic skills the possibility to profit of the knowledge spillovers that are determined once the NC is implemented.

Furthermore, NCs can determine several different degrees of flexibility in their implementation that allow to operate with various forms of contracts. On the one hand, this determines an increase in the range of contract types that are less exposed to variations of the economic environment in the regions in which they are originated. On the other hand, this allows to improve the performance of each involved

**Table 1** Descriptive statistics of contracts by Region

	Number of contracts (1)	Average number of firms per contract (2)	Average number of ATECO codes per contract (3)	Dimension of the network (4)	Average coefficient of variation of employees (5)
Emilia Romagna	32	5.19	2.72	2.28	0.89
Veneto	29	3.55	2.34	1.90	0.88
Lombardy	26	5.81	3.12	2.65	1.05
Apulia	17	4.71	3.24	1.94	1.17
Tuscany	17	10.35	3.18	1.82	0.97
Lazio	12	3.67	2.25	2.00	0.84
Marche	12	5.25	2.50	1.58	1.04
Campania	11	3.45	1.82	2.18	0.83
Friuli Venezia Giulia	10	3.10	2.30	1.40	0.87
Piedmont	10	4.90	3.30	2.40	1.07
Sardinia	10	4.60	1.30	1.30	0.58
Abruzzo	5	8.80	5.40	3.00	1.36
Basilicata	5	6.40	4.00	1.80	1.03
Sicily	5	3.60	1.80	2.80	0.93
Calabria	4	4.50	2.75	1.00	0.39
Trentino-Alto-Adige	3	3.00	2.67	1.00	0.76
Liguria	2	2.50	1.50	1.00	0.99
Umbria	2	3.50	2.50	3.00	0.56
Molise	1	3.00	2.00	1.00	1.20
Overall average		5.08	2.70	2.03	0.93

firm given that it is always possible to select the most appropriate NC for any given specific situation/environment. In general, various degrees of implementation of the NCs determine heterogeneous outcomes in the performance of the involved firms.

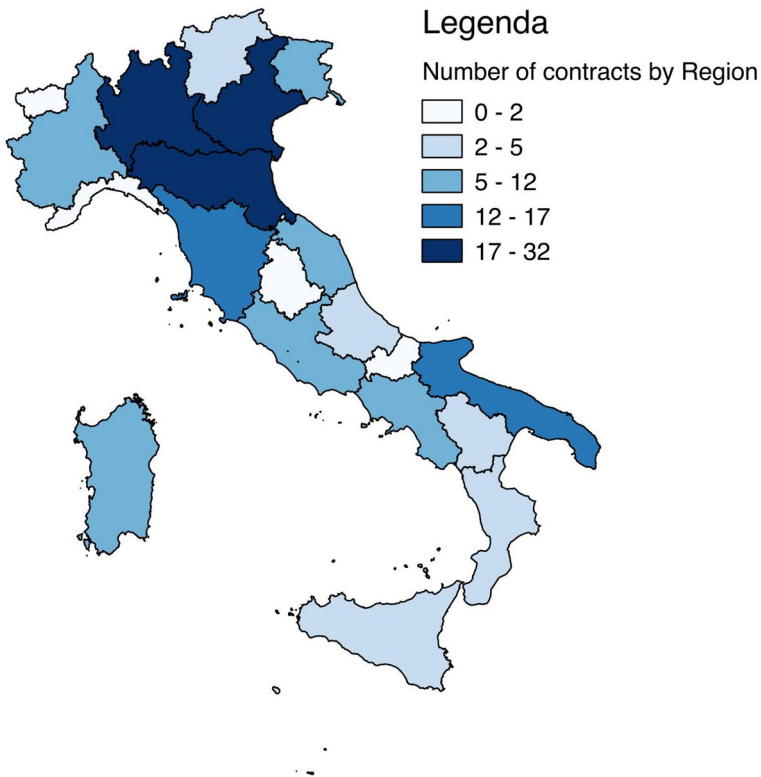
### 3 The empirical analysis

#### 3.1 The dataset

The dataset comprises 213 network contracts (see column 1 of Table 1) signed in 2012 by a total of 1083 firms.<sup>4</sup> On average, the number of firms per network contract

<sup>4</sup> We have chosen the year 2012 for two reasons. The first is that we wanted to analyse the Law in its full working (and the year chosen was three full years since it was issued). The second is that 2012 was the last year available before the Law was revised: in this way we could evaluate the impact of the original NCL.

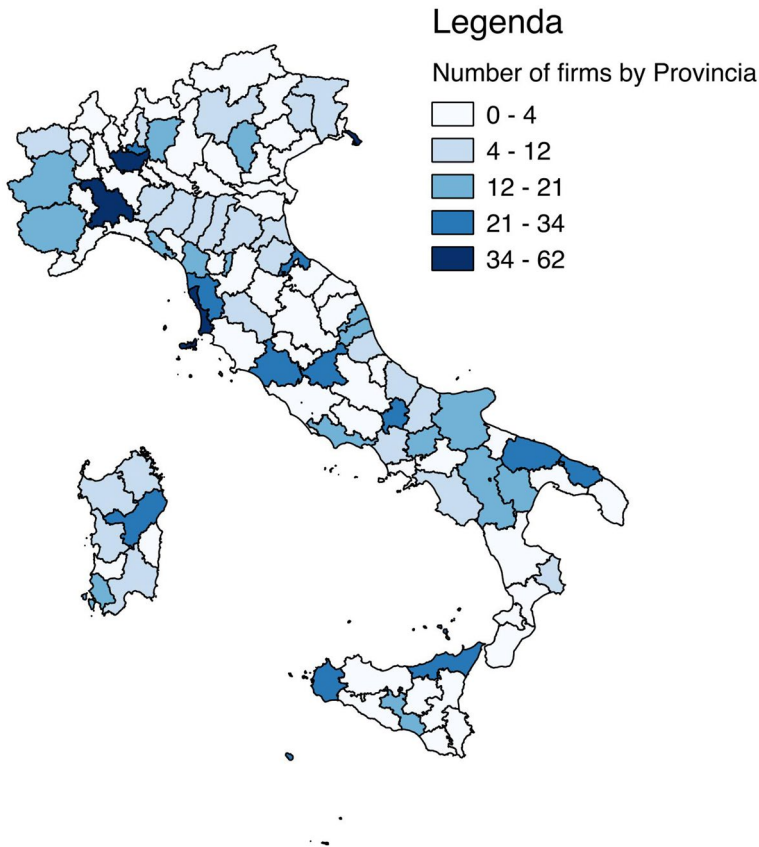




**Fig. 1** Number of contracts by region

is 5 (see column 2 of Table 1), with a maximum of 55. Considering the regional dimension<sup>5</sup> (NUTS 2), it emerges that three Northern Italian regions (Emilia Romagna, Veneto and Lombardy) have the largest share of NC (41%), as they jointly collect 87 out of 213 NCs (see column 1 of Table 1 and Fig. 1). All the Italian regions are represented, but Valle d'Aosta. The geographical dimension of the networks spans on average over two regions, with a maximum of slightly more than 10 firms (36.4% of the total) signed one-region network contracts. Two region contracts involve 267 firms (26.5%), while 226 firms involve three regions (20.9%). By further disaggregating the geographical level, by Italian Province (NUTS 3), it emerges that only few Italian Provinces show a large participation of firms in NC, while many others show no firm (23.6%) (see Fig. 2).

<sup>5</sup> When firms from different regions are part of a NC, we assigned the contract to the region with the largest share of employees.



**Fig. 2** Number of firms by Province

Contracts involve predominantly intersectoral relationships among firms (see column 3 of Table 1), as only 43 NCs (one-fifth of the total) involve only one ATECO<sup>6</sup> code (i.e. only one industrial sector). 83 contracts (39%) and 40 (18.8%) involve respectively two and three ATECO codes. If we consider the number of firms, the distribution is the following: the highest number of firms is in the class of two ATECO codes (306, which corresponds to 28.3%), then 224 are comprised within three ATECO codes and 132 (12.2%) within four, one ATECO code involves 165 firms (15.2%).

Our three hypotheses are the following: a) whether the NCL was successful in triggering firms' networks; b) whether different forms of social capital among firms are reflected in NCs; c) whether NCs are useful instruments to address the geographical and sectoral concentration typical of the Italian economic structure.

<sup>6</sup> ATECO is the classification of economic activities adopted by the Italian Central Statistical Office (Istat), which is the national version of the European nomenclature, Nace Rev. 2. We adopted the two-digit classification.

With respect to point a) we ascertained if NCs were used by firms with previously existent relationships in the form of cross-ownership mainly to take advantage of fiscal incentives. If a cross-ownership is present, we are induced to think that the NC could not be adding true value to the network created by the contract. Indeed, if the participating firms are part of an industrial group, they can already benefit from reaping, for instance, economies of scale and of scope in terms of technology, machinery and some common services.

To verify these hypotheses, we matched the firms in the NC dataset with the Aida-Bureau van Dijk database in order to collect some structural characteristics of the firms, in particular, the organisational form and the ownership assets. We were thus able to obtain data on cross-ownership, and we could classify NCs depending on the firms participating to it being or not cross-owned [the number of contracts comprising firms with cross-ownership in our sample is 84 (39.4%)].

Moreover, we checked whether NCs comprised mixed types of firms. In particular, we were interested in relationships involving both stockholding companies and personal liabilities ones. The reason for this is that we were interested to see if the relationship built with the NC could configure itself as a sort of sub-contracting one that, although legally feasible, would be, as in the previous case, outside the spirit of the law. Indeed, in some cases the relationship between a large stockholding company and some very small ones could configure a network that is very unbalanced and that might not benefit explicitly from the NC but might instead address fiscal purposes. In cases of this type, it is likely that user-supplier relationships constitute an antecedent of NCs: a formalised network relationship that is simply put into a NC, but that did not need such a type of NC in order to be established from the beginning. There are 74 contracts (34.7%) signed between stockholding firms, while the remaining 139 are contracts with mixed types of firms, both stockholding and person liability ones. This difference in numbers between the two types of firms is less reflected in the number of firms for each category. Indeed, the contracts with stockholding companies only comprise 537 firms, while the 139 contracts with mixed types comprise 546 firms. In both cases, we reckon that NCs could simply be an ex-post rationalisation (for fiscal and financial purposes) of already established links and that it could have been carried on even in the absence of NC Law.

As for point b), we mentioned that trust positively impacts networking and relational activities, as social capital decreases uncertainty and, making contracts less incomplete, it is easier for firms the enforcement of contracts. In particular, we expect that social capital, as it reduces the degree of uncertainty in relationships and increases the level of trust, can spur a higher level of collaboration within hybrid forms of collaboration, such as network contracts between firms with different ownership structure that are frequently asymmetric and thus exposed to various forms of exploitation and hold-up. Differently, in the case of relationships based on forms of cross-ownership relationships are more formal and assign precise meaning, duties and responsibilities to the parties involved. In this case, we expect that more formalised types of social capital can be identified, and we use data on participation to associations (for both citizens and firms) as an indicator of more formal and more controllable types of relationships. In this case, a more effective control of the production relationships is possible, and thus firms are able to exert more formal types

of control on their external relationships. The data on social capital are taken from Cartocci (2007), and in particular those on informal social capital are data on participation to election, referendum and on reading newspaper customarily, while those on formal associations refer to the average number of participants to both economic and cultural associations.

Finally, we explore the geographical location of NCs to understand if they are used more in situations where the techno-economic structure could be less favourable to build firms networks (i.e. the South of Italy).

### 3.2 Multi criteria analysis of network contracts

Multi Criteria Analysis (MCA) is a methodology that can be used to estimate how different alternatives have been (or would be in a hypothetical context) able to match a series of heterogeneous, and sometimes contrasting, goals and objectives. It is very seldom the case that one single alternative is the best option with respect to all the aimed objectives or goals of, for example, an investment project or, as in the case of the present paper, of a law. MCA is an analytical tool that can either support *ex-ante* the choices of public administrations often forced to select among alternative options of investment (Gamper and Turcanu 2007) or it can be used *ex-post* to evaluate the degree of consistency between existing projects and the criteria that guided the programming phase.

The main advantage of MCA consists in the use of a series of verifiable criteria. For this reason, the MCA has been widely adopted, and it has become one of the most effective tools for evaluation analysis (Zamparini and Reggiani 2010). Moreover, MCA allows considering objectives or issues that cannot be directly quantified, but that can be the main criteria driving the legislator in the issuance of a certain law. MCA can thus make use of both quantitative and qualitative measurement scales in order to analyse a multidimensional issue.<sup>7</sup>

MCA studies are normally based on the following main phases: (a) identification of the objectives; (b) identification of the alternatives for achieving the objectives; (c) identification of the criteria to be used to compare the alternatives; (d) analysis of the options; (e) ranking of the alternatives (Dodgson et al. 2009). The identified objectives should be specific and measurable. In social sciences, objectives can either be related to the long term (i.e. economic growth or sustainable development) or they may attain to short and medium term as in the case of the output of a policy programme. In the case of our study on NCL, the objective is to test the effectiveness of the Law to promote an increase in competitiveness for firms and the development of technological advances. It is thus linked to both the short and the long term. The alternatives are, of course, the contracts signed in 2012. The criteria chosen to compare the alternatives are based on the analysis of the NCL carried out in Sect. 2. Several criteria were thus chosen, in order to perform the multicriteria analysis: (i)

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<sup>7</sup> This characteristic has, for complex and multidimensional problems, imposed MCA over traditional methodologies, such as the cost–benefit analysis, that requires an economic quantification of all adopted parameters.

number of firms; (ii) number of two digits ATECO codes; (iii) geographical dimension of the network (with a score of one for intra-provincial networks, two for intraregional networks, three for networks including firms of two different regions and so on)<sup>8</sup>; (iv) coefficient of variation of employees; (v) type of contract (whether it included only capital firms or a mix of capital and personal liability firms); (vi) presence of cross-participation (stockholding). Table 1 shows a statistical description of the first four criteria, as the last two are dummy variables for which data are thus not shown.

We consider that a large number of firms, of geographical areas, and of ATECO codes, jointly with a mixed structure of firms, would normally imply the possibility of knowledge spillovers and the diffusion of expertise among firms. As for the coefficient of variation of employees, we assume that a large value would imply a hierarchical structure among the participating firms.

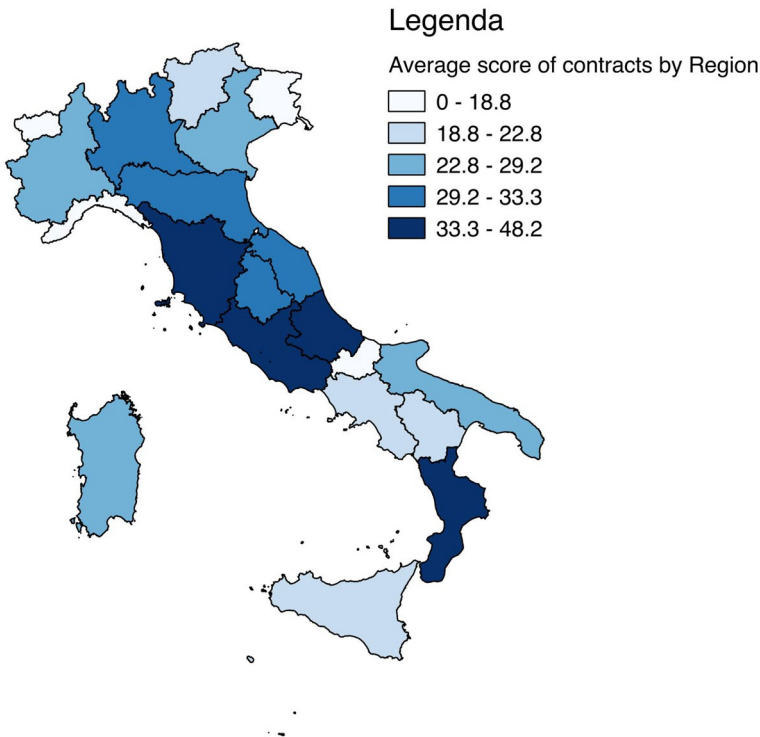
The final two criteria are related to the presence of cross-participation among the firms constituting a NC and to the presence of heterogeneity in firm types. As already said, in case of cross-participation, it is likely that the NC was, at least partially, a legal structure chosen to take advantage of fiscal or other regulations from a group of firms that had tight links before the onset of the NC option. Therefore, if cross-owned firms enter a NC, that contract seems not to be genuinely within the aim and the spirit of Law 134/2012.<sup>9</sup>

The program used to perform the multi criteria analysis is Visual Promethee Version 1.4.0.0 (Behzadian et al. 2010). Several scenarios with respect to the weights attributed to the above-mentioned criteria were considered and a remarkable robustness of results emerged (even considering the possibility to adapt a fuzzy approach to MCA). Results are summarised in Fig. 3 and in Tables 2 and 3. In particular, Fig. 3 allows to compare the geographical dimension of contracts. The Northern Italian regions emerge in terms of geographical representation, while most central Italian regions (Tuscany, Lazio and Abruzzo) and a Southern Italian one displayed the highest average score of contracts. The worst performing regions were Sicily, Campania, Friuli Venezia Giulia, Liguria and Molise. However, it must be noticed that the relatively high values of standard deviations among the scores of NC of each single region testify a large intraregional heterogeneity (Table 2).

No clear pattern emerges between the number of contracts in a Region and its average result. A similar heterogeneity emerges when the single NCs are considered (Tables 3). Eight regions (Lazio, Emilia Romagna, Tuscany, Marche, Apulia, Veneto, Abruzzo, and Lombardy) are represented in the best 15 contracts and 11 regions have at least one contract ranking in the last 15 places. However, all

<sup>8</sup> The score adopted for the geographical dimension was preferred to a measure of average distance, as we were more interested in a measure (sort) of “variety”, rather than of one “pure” geographical distance. Moreover, in most of the cases it would have been fairly impossible to compute and to manage such a measure, given the very high number of firms participating to the NC.

<sup>9</sup> We also reckon that asymmetric kind of NCs, that is, NC between firms with radically different capital and ownership structure, are more likely to be part of vertical relationships of the subcontracting type. This implies, as before, that NC are superimposed as an ex-post structure to already existing networks of firms.



**Fig. 3** Results of the multi criteria analysis

the best 15 contracts have a mixed capital and personal liability structure and no cross-participation (stockholding) while the opposite situation holds for both indicators characterising the worst 15 contracts.

The results of the multi criteria analysis allow to draw some preliminary conclusions with respect to the three hypotheses that this paper aims to test. With respect to the first hypothesis (whether firms have signed NCs in order to fulfil the aims proposed by the legislator), no clear pattern emerges. The high degree of heterogeneity that is present within each single region seems to demonstrate that the considered NCs have in part been signed in order to take advantage of the fiscal incentives proposed by the legislators. Other NCs (those with the highest scores) have been pursued to fulfil the goals of the NC law and likely engendered knowledge spillovers. The same results allow to draw similar conclusions with respect to the second hypothesis related to the possibility that different forms of social capital within firms are reflected in NCs. Finally, to a certain extent, NCs have been a useful instrument to overcome the geographical and sectoral concentration typical of the Italian economic structure. This can be noticed by considering that three central Italian regions, together with a Southern one, show the best overall performers. On the other hand, it should be considered that two other Southern regions are among the worst performers.

**Table 2** Average score and standard deviation of contracts by Region

	Number of contracts	Average score	Standard deviation
	(1)	(2)	(3)
Tuscany	17	48.29	19.03
Abruzzo	5	40.29	19.85
Calabria	4	37.56	15.09
Lazio	12	34.2	23.66
Emilia Romagna	32	33.14	21.37
Marche	12	31.95	21.14
Lombardy	26	31.04	16.69
Umbria	2	30.83	8.99
Apulia	17	28.19	19.42
Sardinia	10	24.08	7.87
Veneto	29	23.92	17.3
Piedmont	10	22.92	7.58
Basilicata	5	22.62	11.02
Trentino-Alto-Adige	3	19.23	5.12
Sicily	5	18.94	14.76
Campania	11	18.93	7.66
Friuli Venezia Giulia	10	18.32	10.7
Liguria	2	12.65	0.33
Molise	1	9.53	–

### 3.3 Econometric analysis of network contracts

In order to complement our MCA analysis, we performed an econometric estimation. As our dataset is a cross section, it is likely to suffer from endogeneity and reverse causality. To deal with these problems, we use an econometric strategy based on a two-step regression. In order to do so, we adapted the model used in Crepon et al. (1998), to assess the impact of innovative activity on a firm's performance, that has been chosen as a way to instrument the model to (partially) correct for the ineliminable problems of endogeneity and reverse causality that always emerge when cross-section analyses are used. Differently from the Crepon et al. (1998) model (that is in three steps), the strategy adopted is a two-step model: (i) the first step deals with the determinants of the patterns with which different relationships arrangements between firms are determined; (ii) the second step uses the relationships output (as predicted by the first step<sup>10</sup>) as explanans in a productivity equation.

<sup>10</sup> They are the linear prediction taken from step one. In this way, rather than having two dummy variables (with very low variability and thus information), by using the linear prediction we have continuous variables, which are able to convey more information than the original dummies.

**Table 3** Results of the multi criteria analysis

Code	N. of firms (1)	Type of contract: only capital (0) mixed (1) (2)	Stockholding: yes (1) no (0) (3)	N. of ATECO (4)	Geographical dimen- sion of network (5)	Coeff. of variation of employees (6)	Promethee Score (7)
1 LAZ06	4	1	0	4	4	0	100
2 ER05	8	1	0	5	4	0.96	84
3 TOS14	10	1	0	5	2	0.63	81.9
4 MARCHE05	5	1	0	4	3	0.63	81.5
5 PUG04	12	1	0	6	3	1.04	78.4
6 ER06	13	1	0	3	3	0.75	78.2
7 TOS13	8	1	0	3	3	0.77	73.7
8 VEN28	10	1	0	6	3	1.14	73.4
9 ER11	8	1	0	6	2	0.84	71.9
10 ABR3	17	1	0	13	3	1.41	70.8
11 VEN21	4	1	0	4	2	0.43	68.4
12 PUG06	11	1	0	6	4	1.76	67.9
13 ER18	4	1	0	3	2	0.15	67.3
14 MARCHE09	14	1	0	5	1	0.54	67
15 LOM22	8	1	0	4	1	0.26	66.8
199 PIE10	2	0	1	1	3	1.27	10.1
200 LOM11	4	0	1	1	2	1.44	10.1
201 SIC01	2	0	1	2	1	0.89	9.9
202 CAM07	2	0	1	2	1	0.9	9.8
203 MOL01	3	0	1	2	1	1.2	9.5
204 VEN15	3	0	1	2	1	1.32	9.3
205 ER21	2	0	1	1	2	1.12	9.2



**Table 3** (continued)

Code	N. of firms (1)	Type of contract: only capital (0) mixed (1) (2)	Stockholding: yes (1) no (0) (3)	N. of ATECO (4)	Geographical dimen- sion of network (5)	Coeff. of variation of employees (6)	Promethee Score (7)
206	2	0	1	2	1	1.09	9
207	3	0	1	2	1	1.44	8.8
208	2	0	1	2	1	1.38	8.1
209	2	0	1	2	1	1.41	7.9
210	2	0	1	2	1	1.41	7.9
211	2	0	1	2	1	1.41	7.9
212	2	0	1	1	1	1.09	7.4
213	2	0	1	1	1	1.41	6.4
Average	5.08			2.7	2.03	0.93	29.25

In the first step of our estimation strategy, a probit regression is run for two separate dependent variables: one dummy variable is related respectively to the existence of relationships among firms with different legal structure (*Type\_of\_contracts*) and to the existence of cross-ownership between firms (*Stockholding\_participation*) as dependent variables. The reasons for this, is that we are interested in checking if more formal or more informal relationships within networks are more important. If firms that already share cross-ownership sign a network contract, we wonder whether the same result could have been obtained without the signing of the contract. That is, we are interested in understanding whether firms are using NCs for other reasons than those related to more efficient production processes.

We then added as co–variates two indexes of heterogeneity<sup>11</sup> for (i) the ATECO categories, in order to asses if and how much a NC spreads outside one industrial sector (*Var\_Ateco*); and (ii) for the Province, in order to asses if and how much a NC spreads outside a certain Provincial geographical level (*Var\_Province*). Moreover, to capture the level of trust characterising a certain geographical area (which is here identified by the Provincial level), we used two additional variables for social capital, one for the more informal kind of relationships between firms with different ownership structure (*Social\_Capital*), and one for the more formal relationships linked to cross-ownerships (*Associations*).

For the second step, we estimated three different models. First, we estimated a Cobb–Douglas functional form (Cobb and Douglas, 1928) of the type:

$$L \text{ Value Added} = \beta_0 + \sum_{k=1}^4 \beta_k x_{ik} + g^T Z_i + e_i \tag{1}$$

where the dependent variable is the natural logarithm of the value added for firm *i*. As for the co–variates, we used the natural logarithm of the inputs of production: costs of production, material and immaterial immobilisation, plus the two co–variates from the 1st step, finally  $e_i$  is the error term. We control for regional effects by including specific dummies. Then, we estimated a translog functional form (Christensen et al., 1971):

$$L \text{ Value Added} = \beta_0 + \sum_{k=1}^4 \beta_k x_{ik} + \sum_{k=1}^4 \sum_{j=1}^4 \beta_{kj} x_{ik} x_{ij} + g^T Z_i + e_i \tag{2}$$

where the dependent variable, the main inputs of production and the controls are the same as in Eq. (1) while the term  $\sum_{k=1}^4 \sum_{j=1}^4 \beta_{kj} x_{ik} x_{ij}$  contains squared and interaction terms. When the latter term is equal to zero, the translog model reduces to a Cobb–Douglas. Finally, we estimated a stochastic frontier model (Kumbhakar and Lovell 2000), in which the error term  $e_i$  of Eq. 1 is decomposed in two terms:  $e_i = \varpi_{it} - u_{it}$ , where  $\varpi_{it}$  (i.i.d.  $N(0; \sigma_v^2)$ ) accounts for random variations of the

<sup>11</sup> The index utilised is the Gini heterogeneity index:  $G = 1 - \sum f_j^2$ , which is then standardised to take account of the diversity in the number of either ATECO or Province in each network contract.

**Table 4** Probit regression on type of relationships

	Type of contract (1)	Stockholding participation (2)
Var_Province	−0.804*** (0.136)	−0.272* (0.131)
Var_ATECO	−0.518*** (0.129)	0.319* (0.150)
Social_Capital	0.285* (0.131)	
Associations		0.129* (0.066)
Constant	−0.755*** (0.110)	−0.142 (0.101)
N	497	387

Standard error in parentheses—\* $p < 0.10$ , \*\* $p < 0.01$ , \*\*\* $p < 0.001$

frontier (i.e. for possible measurement errors) and  $u_{it}$  (i.i.d.  $N(0, \sigma_u^2)$ ) is the inefficiency error term measuring the difference between the actual level of innovation and the technical inefficiency, which we assume is half normally distributed. This last procedure allows us to calculate the inefficiency level of the firms' performance, and moreover it is possible to correct the estimated efficiency for heteroskedasticity due to different size of the firms.

The results for the first step of our estimation procedure are shown in Table 4. The first column shows the results for the probit regression for the dummy variable indicating the partnership relationships, while the second column shows the results for the dummy referring to the cross-ownership of enterprises.

We have also computed the marginal effects, to measure the amount of change in the dependent variable that is produced by a 1-unit change in a co-variate, holding all other variables at their means.

As far as variability in the distribution in ATECO and in Province is concerned, they appear to be both statistically significant. Variability in province is negatively correlated to both dummies meaning that high variability does not imply an increase in firms' relationships, but the opposite is true: firms tend to establish relationships or cross-ownership in close geographical environments. While the variability of the industrial sector has an opposite impact on the two different types of productive relationships: it is negative in the case of relations between firms with marked differences in the organisation structure, meaning that they are likely to be relationships of the "subcontracting" type. In the case of the cross-ownership dummy, the positive impact of variability in the industrial structure is probably related to the fact that cross-ownership is more likely to follow patterns not strictly linked to industrial purposes, and therefore in many cases they are likely to be either financial or fiscal. Also, the patterns with which trust enters the picture are different, as production-based relationships are more likely to be informal, and thus they benefit from forms of social capital that are not very linked to formal arrangements, while they are more requested in the opposite case, when the relationship is based on contracts and offers more possibility to monitor the relationships based on formal types of trust.

The marginal effects are quite dissimilar, as they are in general higher for the firms that are not showing cross-ownership (i.e. they are 30% for firms with different ownership versus 10% for Cross ownership for Var\_Province respectively,

**Table 5** Estimation of the production functions

	(1)	(2)	(3)
Production Cost	0.725*** (0.066)	(0.368) 1.157**	0.686*** (0.036)
Material Immobilisation	0.159*** (0.037)	−0.0106 (0.195)	0.0627* (0.025)
Immaterial Immobilisation	0.0379* (0.021)	−0.0815 (0.119)	0.0458* (0.018)
Type_of_Contract	−0.199* (0.101)	−0.180* (0.097)	−0.169** (0.063)
Stockholding	0.454* (0.213)	0.493** (0.186)	0.394** (0.147)
Prod Cost <sup>2</sup>		−0.0582 (0.039)	
Mat Imm <sup>2</sup>		−0.0253 (0.017)	
Immat Imm <sup>2</sup>		0.0242* (0.011)	
Mat Imm*Prod Cost		0.0735* (0.041)	
Immat Imm*Prod Cost		0.0189 (0.030)	
Immat Imm*Mat Imm		−0.0356* (0.016)	
Constant	0.032 (0.505)	−1.067 (0.939)	1.198*** (0.219)
Regional dummies	Yes	Yes	Yes
Insig2v			−1.916*** (0.170)
Insig2u			
Size			−0.869*** (0.125)
Constant			1.049*** (0.266)
<i>F</i> test of Cobb–Douglas model		5.14 (6.127)	
adj. R2	0.86	0.868	
<i>F</i> test of joint significance	104.96 (15.127)	204.70 (21.127)	
N	355	355	315

Robust standard error in parentheses— \* $p < 0.10$ , \*\* $p < 0.01$ , \*\*\* $p < 0.001$

and 19% versus 12%). Also, the impact of the two different forms of social capital is twice for the former. This shows that the impact of our co-variates in a sample of firms that signed NCs is higher when firms that participate in them are not already linked by formal relationships of dependency as evidenced by the presence of cross-ownership.

The results of the second step are shown in Table 5, where column 1 refers to the Cobb–Douglas specification, column 2 to the translog specification, and column 3 to the stochastic frontier one. With these different functional forms, we tried to measure two important elements in evaluating NCs. By means of the former two, we look at efficiency with which firms operate within NCs. With the latter, we aim at understanding how firms behave with respect to the technological frontier, and thus if they increase their innovativeness. The results for the translog specification, present an *F*-test to test whether the term equals zero. Since the test cannot reject the null hypothesis at the 1% level, the correct model to test is the Cobb–Douglas one. Also, the stochastic frontier regression confirms the robustness of the results in terms of both their statistical significance, signs and magnitude.

The Cobb–Douglas specification returns the expected results, as far as the production factors are concerned, costs of production (that includes also cost of

personnel) and both material and immaterial immobilisation (which proxy respectively for capital the former, and marketing and R&D the latter) have all positive and significant impact on value added. These results are confirmed, as a robustness test, by the other two specifications adopted.

Finally, and more importantly, when we add the two co-variables of subcontracting and cross-ownership variables, quite interesting results emerge. Indeed, they show that cross-ownership improves the performance of the firms involved, while the participation of different types of firms to a NC decreases their performance. Our estimations seem thus to furnish some positive support to hypotheses (a). On the other hand, they seem not to support hypothesis (b). Lastly, although only indirectly, they can give some support to hypothesis (c). Cross-ownership seems to have a positive impact on the performance of firms involved in NCs. These firms complement their performance with the implementation of additional formal relationships in the form of network contracts, thus benefitting from the opportunities of NCs. On the contrary, contracts among firms of different organizational structure (*Type\_of\_Contract*) negatively impact the production function, thus hinting to the fact that firms with sort-of subcontracting relationships do not seem to benefit from the participation to NCs. In these cases, firms seem to use NCs more as an ex-post rationalisation of already ongoing relationships.

Although our estimates cannot provide hints on the North–South divide, the positive role of social capital in the first step of our estimates seems to imply that social capital might be a complementary, rather than substitute, element to NCs. In this way, NCs seem to need some sort of pre-existing level of trust. This is historically more present in the Northern and Central regions, and less in the South of Italy. NCs seem to be an instrument based on already established trust relationships. These results confirm the unclear relationship displayed in the previous section based on MCA.

## 4 Conclusions

In this paper, we carried out an analysis of the main results of Law on Network Contracts, issued in Italy on the 9th of April 2009 with the aim to trigger the formation of networks of firms. The analysis of the performance of all limited liability firms that participated a network contract in 2012 shows interesting results, in particular as far as the reliance of the law in spurring firms' competitive performance is concerned. Indeed, as our empirical analysis shows, there is a clear pattern behind the ways in which firms decide to participate to these forms of partnerships related to two main dimensions: the presence of cross-participation, in terms of cross-stockholding, and whether the network contract included only capital firms or a mix of capital and personal liability firms. These appear to be the main co-ordinates along which it is possible to evaluate the effectiveness of the legal instrument adopted. In particular, it emerges from the empirical analysis that the network contract seems to be well suited to answer to the different needs of firms involved, accounting for heterogeneity of the regional industrial structure. This provides support for hypothesis

(a) related to the possibility that firms have signed NCs in order to fulfil the aims proposed by the legislator.

Indeed, NC law seems to act in a complementary (and not in a substitutive) way. As the econometric results show, the existence of a mix of full and limited liability companies seems to negatively affect the performance of the firms involved while they actually rank in the top positions in terms of multi-criteria analysis. This suggests that this type of contracts could allow firms to overcome the rigidities involved in an asymmetric kind of relationship due to the heterogeneous characteristics of firms in terms of proprietary structures (and obviously of governance). The opposite seems to hold when the joint shareholding among firms within network contracts is considered. In this case, as this type of relationships appears to have a positive impact on the economics performance, they are not specifically targeted by the network contracts, and thus they rank at the bottom of the list in the multi-criteria analysis. Therefore, a joint interpretation of our empirical evidence provide support for hypothesis (b) on how different forms of social capital among firms are reflected in NCs.

Finally, the joint analysis produced also some useful results for hypothesis (c) on the likelihood that NCs may represent useful instruments to overcome the geographical and sectoral concentration typical of the Italian economic structure. Indeed, as the analysis was based on two different methods of analysis, we are able to draw some concluding remarks obtained from the combination of the results obtained by each empirical investigation. Hence, our analysis shows that NCs have an impact on the Italian North–South divide, as both the multi criteria and the econometric analysis confirm that the South of Italy somehow seemed to have benefitted from NC law. The econometric evidence in fact supports the importance of social capital for firms' performance, and the MCA partially confirms that NC Law seems to target more firms in the Southern regions of Italy.

The empirical results of this paper allow to draw some relevant policy implications. First, it would have been desirable for the legislator to propose a system to rate the performance of the network. Such a rating system might be linked to forms of incentives providing tax relief for firms participating in a successful NC. Second, the Law should consider explicit forms of dissemination of information in order to favour the diffusion of NCs throughout the country. Third, network contracts should allow the participation of foreign firms to NCs, with the aim of attracting best practice firms that might provide useful spillovers to Italian companies. It appears that the juridical innovation carried out between 2012 and 2015 did not focus explicitly on these important topics.

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