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ITALIAN INTERLOCKING DIRECTORATES:

STRUCTURE, EVOLUTION AND CROSS-COUNTRY COMPARISONS

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Ai miei genitori,
la mia ancora nei momenti di gioia,
il mia vela in quelli di dolore.

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ABSTRACT

Interlocking directorates have historically represented an important characteristic of the Italian corporate network. Pyramidal groups and low developed capital markets have fostered this phenomenon. Nevertheless, the Italian interlocking directorates have registered earlier erosion than in other countries. Analyzing the ties between the 250 largest Italian firms, this work reveals that the major forces shaping the structure of the Italian interlocking directorates are the long-term commitment of banks in financing private companies, the level of shareholder protection and the role of the state in the economy. Cross-country comparisons sustain the first two results, while the effects of state intervention remain ambiguous.

Key words: interlocking directorates, mixed banks, corporate governance, business system.

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I. Introduction

"An interlocking directorate occurs when a person affiliated with one organization sits on the board of directors of another organization" (Mizruchi, 1996). The reasons behind this situation have been speculated over time by many scholars; a uniform answer to this issue, however, is not still reached. In particular, a major separation exists between studies that consider interlocking directorates (IDs) as a result of behavioral attitudes of corporations, and studies that relate IDs to the taxonomy of underlying structural characteristics. This work adopts the second approach, considering the peculiar traits of Italy in terms of corporate governance, shareholder protection, business system and state intervention.

Nevertheless, by using social network analysis measures and by analyzing the sectors at the center of the network, some speculations about possible behavioral effects of IDs are drawn. In particular, this work reveals that some sectors and companies tend to assume a more central position than others and that this situation is persistent over time, suggesting the existence of specific corporate strategies behind IDs choices. The analysis of the structure and the shape of the network, instead, allow extrapolating the type of relationships existent between the interlocked firms and their relative power.

The research is conducted through the application of social network analysis techniques to a sample composed by the 250 largest - 50 financial and 200 non-financial - Italian firms. Using the structure of interlocking directorates existent between the 250 largest Italian companies, this work explores how the Italian corporate network is structured in 2011 and how it has evolved over the past decade, as a result of the economic crisis and the introduction of new laws of corporate governance.

Furthermore, a long term analysis is conducted, adding the findings for 2011 to other seven benchmark years, according to data provided by Rinaldi and Vasta (2012). The trend analysis will permit to relate changes in the structure of the Italian interlocking directorates to the major breakthroughs and to identify which forces play a major role in shaping companies' ties.

Finally, in order to give a stronger support to the analysis and reach more robust conclusions, the structure of the Italian IDs is compared with the network's structure in five other countries - France, Germany, Portugal, UK and US - with different levels of shareholder protection and diverse corporate governance models and economic systems.

The work is organized as follow. In section II, a literature review underlines the importance of IDs studies and the gaps that the literature still presents. In section III, a description of the data and the methodology used to develop the research is provided. Section IV provides long-term insights of the top Italian companies' structure in terms of board size, state participation, sector of business activity, and board model. Section V gives a brief overview of the Italian corporate laws for what concern the board models and the limits to functions accumulation. The results of the social network analyses are provided in section VI, which shows how the Italian corporate network is structured at the end of 2011 and which companies are playing the most central role. In section VII the trend analysis reveals the causes that have determined over time the main changes in the Italian interlocking directorates, including the effects that the new corporate governance models and regulatory provisions have played in shaping the corporate networks' structure. In section VIII, a comparative analysis shows that some of the conclusions reached in section VII for Italy are also true at a cross-country level. This work concludes with a review of the main results of the research.

II. Literature review

The first investigation on interlocking directorates was conducted in the United States by the Pujo Committee - House Subcommittee of the Committee on Banking and Currency - in order to inspect the "Money Trust": the presence of a powerful group of bankers and financiers able to control, through the influence on financial and monetary conditions, the largest industrial and railroad companies. The Pujo Committee's investigation was not therefore inspired by economic purposes, but by political reasons, being the concentration of power considered a threat to "the democratic constitution and the liberal traditions of the United States" (Windolf, 2002). In effect, the research unveiled strong corporate networks created around the biggest financial institutions and, consequently, the Clayton Act (1914) was issued to prohibit interlocking directorates between competing firms (Windolf, 2002).

After this first study conducted in 1912-1913, academic research in interlocking directorates had become numerous and extensive. In order to provide a clear idea of the main contributions on the area of IDs, I will divide the literature in three main fields of study. A first stream of research investigates the behavioral causes and effects of interlocking directorates and summarizes the main functions of interlock ties. A different body of literature analyzes IDs on the basis of country specific characteristics related to the type of business system adopted and identifies the structural conditions able to influence IDs formation. In this perspective, the relative importance of IDs is associated with the taxonomy of business systems. Finally, more recent research emphasizes the role of transnational IDs in facilitating cross-border exchanges and promoting European cohesion.

II.I Behavioral effects of interlocking directorates

One of the earliest studies in this field was conducted by Scott in 1985. The contribution of Scott (1985) is particularly relevant because it identifies five different models explaining IDs' functions to which subsequent research can be related.

The first approach developed to explain interlocks is the "financial capital model" or "Marxist model". According to this viewpoint IDs are created around financial institutions in order to allow an easy exchange of information between financial - mainly banks - and non-financial firms. This flow of information would benefit both banks and non financial companies, granting to the former a reliable monitoring over firms' solvency conditions and to the latter an easier access to finance.

The second approach is the "coordination and control model", which sees interlocking directorates as mechanism allowing a bank or a family to exercise corporate control. The difference between the "financial capital model" and the "coordination and control model" lies on the fact that while in the former interlocks in both directions are conceived, in the latter IDs are formed by banks or families with the explicit intention to create a situation of predominance.

A third model is "the resource dependence model" according to which companies create IDs in order to reduce their vulnerability in scarce resources' allocation and to better manage their relations with critical counterparts.

According to the "managerial model" instead, companies are organized à la Berle and Means (1932), with decision power allocated to managers and consequent low direct influence of the board of directors on day-to-day decisions. In this perspective, interlocked directors are not able to influence company's choices on a daily basis. However, by appointing and removing managers, directors are able to provide the

company with an "environmental scan" and to increase companies' prestige and public legitimacy.

Finally, "the class cohesion model" emphasizes the role of the business elite trying to reach economic and political cohesion. Corporate interlocks are in this sense means of communication able to transmit and diffuse the same ethic across various companies and industries.

Starting from these five models, many causes have been speculated across the years to explain the reasons behind IDs formation. In summarizing previous literature in this field, Mizruchi (1996) distinguishes between the inter-organizational and the interclass perspective. The first viewpoint focalizes on the benefits interlocked companies seek to obtain through their ties with other organizations, and identifies in these possible benefits the main causes that induce companies to create IDs. Collusion, cooptation, monitoring and legitimacy belong to the inter-organizational perspective.

Collusion was probably the first aspect to raise concern: the Clayton Act prohibiting IDs among competing firms since 1914 is the confirmation of such fear. Pennings' (1980) finding of a positive correlation between market concentration and horizontal ties seems to support this concern. The U-shaped relation between concentration and IDs discovered by Burt (1983) leads to similar conclusions: when concentration increases IDs density increases too. However, this is true only until a certain level of concentration after which, to an increase in concentration is associated a decrease in density. This result suggests that when markets are highly concentrated, companies do not need to create interlocks in order coordinate their activities. The use of collusion as a possible explanation of IDs is not exempt by critiques. Baker and Faulkner (1993) argue for example that IDs are not a necessary condition to reach

collusion, as the US scandal of price-fixing in the market of electrical equipment showed in 1960s, despite the IDs prohibition. Other studies (Carrington 1981, Meeusen & Cuyvers 1985, Baysinger & Butler 1985) focalize on discovering a possible relation between IDs and profitability: starting from the assumption that if IDs facilitate collusion, higher profits and better performances should result from this anti-competitive behavior. However, results in this issue are widely different and not significant relationships can be drawn between IDs and profitability.

Given the impossibility to identify in collusion the main cause of corporate interlocks, the attention was progressively focused on cooptation and monitoring. Even if different in their purpose, cooptation and monitoring have the same underlying issue: to deal with scarce resources. To explain the two possible interpretations, we can consider and analyze the presence of bank representatives on the board of directors of non-financial firms. This kind of interlock may be explained by the attempt of the non-financial firm to co-opt within the organization an element of uncertainty in order to increase its ability in obtaining financing - as the "resource dependence model" (Scott, 1985) would predict - or can be the result of the bank's need to monitor debtor's company and performance - more in line with the "financial capital" and the "coordination and control model". This second explanation is supported by the tendency of banks' representatives to join underperforming non-financial firms. Nevertheless, critics do not exempt this explanation as well. Mitzuchi (1996) highlighted the fact that, lacking clear and reliable data, it is impossible to identify if interlocked directors are member of the lender bank or not. Moreover, the fact that many of such interlocks broke for reasons not related to the willingness of the company - such as director death - leads many researchers (Ornstein 1980, Palmer 1983) to exclude cooptation and monitoring

as possible causes for IDs.

Legitimacy, compatible with the "managerial model" of Scott (1985), is probably one of the causes that has received less critiques over time, the board of directors being for its nature a strong mean to obtain public legitimacy. However, research on this field is not flourishing given to the difficulties related to an empirical identification of this kind of cause. Moreover, legitimacy is strongly linked to cooptation and the two causes can be considered overlapping, being the cooptation interpretable as a way to attain legitimacy as well (Mizruchi, 1996).

Williamson (1985) adds another cause to those identified by Mizruchi (1996). In particular, Williamson (1985) relates the presence of IDs to the willingness of companies to reduce transaction costs. Transaction costs tent in fact to be higher in market deals than in coordinated exchanges, the information being in the latter more complete and the risk of opportunistic behavior from the counterpart lower.

The inter-organizational perspective examined above identifies the main causes of IDs in the possible benefits companies can get from corporate ties. Differently, the inter-class perspective, developed on the light of the "class-cohesion model", considers IDs as the result of an "oligarchic control" coming from a small group of business elite with strong ties among them and with the political class, exercised in order to have a privileged access to finance, to restrict the competition and to diffuse "political unity" across industries (Rajan & Zingales, 2003).

Relevant can also be the analysis of the factors inducing directors to accept offices in more than one company. In this perspective, the desire to advance in their career, to obtain personal prestige, and to create their own network (Useem, 1984) are possible reasons of IDs suggested by the "career advancement model".

Many are therefore the hypotheses that have been stated across the years to explain the reasons at the basis of IDs; however, critiques have saved none of them. To overcome these different interpretations, some scholars adopt a different approach: instead of focalizing on the causes pushing companies to interlocks, they study the effects that such ties have on communication, scarce resources allocation, information flows and political unity.

Studies on the behavioral effects of IDs show that interlocks are able to align and influence choices and practices adopted by interlocked firms. Moreover, companies with a high number of interlocked directors tend to adopt similar strategic decisions. For example, interlocked companies are more likely to adopt poison pills (Davis, 1991), to be acquired friendly (D'Aveny & Kesner, 1993), to not repurchase shares at higher prices (Kosnik, 1987), to grant golden parachute to CEO (Cochran et al, 1985), to have higher levels of external debt (Mizruchi & Stearn, 1994) and to adopt a multidivisional structure (Palmer et al, 1993). Despite a causal-ordering problem can affect those behavioral consequences, Shropshire (2010) found that information transmitted through interlocks have a great impact on corporate strategies, given the interlocked director access to a detailed knowledge of practices and strategies implemented in other companies, knowledge that would be, otherwise, difficult to acquire by an outsider.

Remaining on the behavioral consequences of IDs, Milliou (2004) investigates the effects of information flows on R&D spending. Milliou research is conducted through the analysis of the relations between vertically integrated firms but, assuming that information flows happen even in presence of IDs, the results can be extend to the case interlocking ties as well. In particular, the work investigates the foundation of the Antitrust Authority's concern as regard as the negative effects of a possible access to

confidential information on competition and R&D spending. Milliou findings do not support the Antitrust Authority's concern: the total spending on innovations as well as the total output are in fact higher in integrated firms than in non-integrated firms, and such differences tend to increase with the increase on R&D spillovers. This result is the consequence of the fact that under R&D spillovers, the integrated firms can fully appropriate the benefits of R&D investments, which in turn allow them to increase their output raising the value of any costs reduction and incentivizing even more the investments on R&D. The positive effect that the non-integrated firm is able to obtain is a lower wholesale price to pay to the integrated company. The non integrated firm, reducing the demand for inputs, will in fact lead the upstream integrated firm to reduce the wholesale price in order not to lose profits. Even if the lower wholesale price reduces the cost advantage of the downstream integrated firm, the increase in production it is able to obtain dominates on the cost effect, allowing the integrated firms to increase their profits at the expense of the non-integrated one. The net effect on social welfare depends instead on a number of factors: if R&D is very costly, products are close substitutes and the degree of spillover is particularly high, the social welfare will suffer from information flows. By contrast, in the absence of such conditions that reduce the incentives to innovations even for the integrated firms, information flows create a higher final result.

Always in the field of information flows, Asker and Ljunqvist (2010) analyze the effect of the relations between investment banks and companies issuing securities. Companies that operate in an industry which is highly concentrated and strongly dependent on intangibles are more influenced by soft information and have the tendency to establish an exclusive relation with their investment bank. This result shows that,

despite the negative effects the exclusive tie can lead in terms of higher fees and lower bank's expertise, companies perceive information leakages as more costly and allow banks to assume a hold-up position.

Di Donato and Tiscini (2009) investigate instead the effects of IDs between financial and non-financial companies on leverage and cost of debt. They found that companies with banks representatives in their board tend to have higher cost of capital and lower leverage - debt/equity - ratios. This result would contrast the hypothesis according to which non-financial companies co-opt banks directors to have an easier access to finance, and it is more in line with the "coordination and control model" formulated by Scott (1985); that is, banks interlock in order to monitor debtor companies and to press on them to lower their financial exposure.

In conclusion, numerous studies try to understand the causes and the consequences of interlocking directorates but doubts still remain regarding what drives companies to create IDs and the effects of such relations on the companies' performances. However, despite many questions remained unanswered, interlocking directors continue to be considered a strong sign of corporate ties (Mizruchi, 1996) and the growing attention posed by the legislators on this issue seems to confirm that IDs can have the potential to influence companies' relations and competitive environments. In particular, interlocking directorates provide important channels of information flows and means of control that are successfully exploited by some companies, while others even fail to perceive their existence (Abramovitz, 1986).

II.II Structural causes of interlocking directorates

Differences between countries in IDs structure and density seem to be significant and persistent over time, suggesting the existence of some conditions enhancing or inhibiting the formation of networks.

In order to analyze cross-country differences, several approaches have been developed over time. The "law and finance" approach (La Porta et al, 1998) sees in shareholder protection the main determinant of different ownership structures and corporate networks choices. Corporate networks in general, and interlocking directorates in particular, constitute in fact a significant trait of the corporate governance system adopted, and are in turn affected by it.

Companies incorporated in countries with traditionally high shareholder protection, typically common law countries, present a separation between ownership and control obtained through an organization à la Berle and Means (1932), with a wide dispersed share capital and decision power allocated to managers. Directors do not have influence on day-to-day decisions and therefore IDs cannot have a direct impact on companies' operational choices and results. Differently, companies in civil law countries where shareholder protection is traditionally low need to find alternative ways in order to safeguard shareholders' rights. The creation of pyramidal groups and corporate interlocks are common solutions.

Exemplar is in this sense the case of Italy where the most relevant features of the corporate governance system are, according to Gambini et al. (2009), voting agreements, reciprocal participations and complex pyramidal groups that allow a large corporate control with small investments. The separation between ownership and control cannot in fact be reached strengthening the managerial power because of the

inadequate shareholder protection (Bianchi et al, 2001). Also, the traditional control exercised by financial institutions over industrial firms is hindered by restrictions for banks to accumulate voting proxies. Moreover, despite the Italian legislator has recognized the importance of ownership structure since 1940s and established the lowest European threshold for the disclosure of cross-participations (2%), the more favorable dividend taxation policy makes companies participations more convenient if held by another corporation rather than by physical persons.

As a result, in the 1996 more than half of the Italian non-financial firms belong to a pyramidal group headed by a family, a coalition or the State, whereas financial institutions assume only a marginal role (Bianchi et al, 2001). This structure, reinforced even more by cross-ownerships and interlocking directorates, has permitted a "stable control over both small and large companies" (Bianchi et al, 2001), with little or no changes over the years.

Therefore, even if pyramidal groups and corporate networks were conceived as a mean to overcome lower shareholder protection and the underdevelopment of financial markets, they tend to obstacle the market for corporate control, in this way strengthening the position of influential families at the disadvantage of minority shareholders and capital market efficiency (Gambini et al, 2009). In recent years, however, especially with the introduction in 1998 of the Testo Unico della Finanza, the new Italian law for listed companies, pyramidal groups started to assume a decreasing role in favor of a strongest control from the financial sector (Bianchi et al, 2001).

More recent studies show that ownership structure and corporate networks are not stable over time and IDs' configurations tend to change according to changes in the dominant "interest group". In this sense, the "political economy approach" (Rajan &

Zingales, 2003) considers the state as one of the possible dominant influence groups, suggesting the possibility to relate the role of the state in the economy to the importance of IDs. Again, Italy constitutes a typical example since state-owned enterprises, incentivized by natural resources scarcity and a small domestic market, have historically played a central role in the Italian economy, especially in capital-intensive industries. The great influence of the Italian state over the economy started in 1933, when the *Istituto per la Ricostruzione Industriale* (IRI) was founded by the state to save banks and non-financial firms from bankruptcy, and was fostered in later years with the creation of ENI (*Ente Nazionale Idrocarburi*) in 1953 to sustain the energy sector after the War World II. The nationalization of the energy sector in 1962, in particular, determined an important point in shaping the Italian ownership structure because ended the previous links between industrial and financial firms to strengthen the position of the State and of powerful families (Rinaldi and Vasta, 2009).

During the "Golden Age" (1972-1883) the state intervened in the economy in many forms in order to foster the convergence of Italy with more technological advanced countries, providing firms with the lacking factors needed for the industrialization. In those years, IDs assumed an important function in stabilizing private companies and granting them a strong connection with state-owned enterprises.

Partially in line with the political economy model, other scholars explain cross-country differences arguing that corporate interlocks are the result of specific institutions existent in a certain country, in a specific period of time. Corporate networks are themselves "invisible economic institutions" able to coordinate market exchanges, facilitate innovation diffusion, have access to confidential information or function as a control, monitor and discipline mechanism. There are three main

approaches following this line of thought. The "cultural inheritance approach" (Panofsky, 1951) tries to explain cross-country differences on the basis of the peculiar behaviors and habits embedded in different cultures, while the "economic development or modernization theory" (Abramovitz, 1986) underlines that to different levels of modernization correspond different kinds of institutions. However, probably the most important contribution in this field was developed by Hall and Soskice (2001) that with their "functional interdependence approach", emphasize the role of institutions' complementarities.

According to Hall and Soskice (2001) institutions tend to be self-reinforcing because of their complementarities; in fact, it is not possible to change one institution if all the others remain equal. This assumption leads to expect that ID's structure will differ among countries according to the type of market economy historically adopted and the "Varieties of Capitalism" (Hall et. all, 2001), emphasizing the role of IDs as an instrument of coordination, draw an important distinction between liberal market economies and coordinated market economies.

In liberal market economies free competition regulates exchanges and prices are determined by the law of the demand and supply. Markets are therefore seen as the main institution in coordinating relations among companies. Differently, in coordinated market economies non-market relationships dominate exchanges and are fundamental in providing the access to confidential information. In this context IDs and networks in general, are useful in creating companies' interactions and in strengthening trust and cooperation. The peculiarities of the Italian type of economy lead some theorists to classify Italy among the "state-influenced market economies", which group those countries with a more ambiguous position, playing the state a prominent role (Rinaldi

and Vasta, 2012).

In line with Hall and Soskice, Windolf (2002) emphasizes the relation between corporate networks and the type of competition regulating markets. Countries that have traditionally based their economies on free market rules are generally characterized by efficient capital markets and stricter antitrust regulations. Exchanges are based on arms-length transactions and free competition is viewed as the best solution to efficient economic system. Consequently, networks and interlocks are seen as ways to distort competition, hindering not only the free trade but also the "democratic constitution and the liberal traditions" over which the State is built (Windolf, 2002). Conversely, countries that have traditionally based their economy on cartels and cooperation are countries where capital markets are traditionally inefficient or inexistent and coordination is a possible solution to market imperfection. Pyramidal groups and IDs are therefore seen as possible solutions to market imperfections by creating a different form of "organizational efficiency" (Goto, 1982).

Another important difference between liberal market economies and coordinated market economies is reflected by the way companies finance themselves (Carroll and Fennema, 2002). In fact, in the absence of efficient capital markets, companies are obliged, in order to finance their operations, to heavily rely on bank's credit. This strong exposure to non-financial sectors, unable banks to easily withdraw their money invested in private companies, and obliges them to find different ways to exercise their voice. The results of many studies unveiling the centrality of banks in the IDs network system are therefore consistent with this situation.

However, according to the "convergence thesis" cross-country differences are not able to persist over time as market liberalization and deregulation increase within a

country. This theory is based on the underlying assumption that coordinated market economies are less efficient than liberal market ones. However, evidences show that some coordinated market countries are able to outperform liberal market economies, albeit the high IDs' density. As Goto (1982) suggests, due to the benefits that firms can get from cooperation and lower transaction costs, regulated competition can be as efficient as market competition.

II.III Transnational interlocking directorates

More recent research (Kratzer and Van Veen, 2011) focus the attention on interlocks formed among different European countries. These studies, even if at their first stage, are important in order to understand if national interlocks decline can be explained by their progressive substitution with cross-country interlocks. In particular, these studies are conducted in order to appreciate the success of the European attempt to create a common market among member countries. In this perspective, IDs acquire a new function in measuring the level of European integration and the emergence of European elite (Carroll & Fennema, 2002). Furthermore, an analysis of the role played by different countries in such transnational networks can explain cross-country differences and help to understand which underlying factors influence the role assumed by each country in the European network. In this sense, Kratz and Van Veen (2011) found that the position of a country in the European network is significantly affected by the time-length of its membership in the European Union and by the structure of IDs within the country itself.

Different is the approach followed by Rauch (2001) which investigates the impact of transnational networks on international trade. In a globalized world where new means

of transportation and communication potentially allow even small firms to establish international business relationships, to find the right partners is the most difficult task. Weak enforcement of international contracts and inadequate understanding of cross-country differences are usually the main barriers hindering international trade. In this sense, substituting legal enforcement and information disclosure by trust, transnational networks can facilitate cross-country exchanges. Moreover, products quality can benefit from international networks as well; in fact, given a higher probability to internalize the benefits of R&D investments, the incentives on R&D spending and quality improvements are also higher. However, the risk of anti-competitive effects exists: international networks may allow tied firms to collude and to exclude the outsiders from the market. In addition, Rauch raises the question of a possible contrast between national and transnational networks. National companies may, in fact, try to collude creating a stronger national network in order to protect the local market from foreign competition.

As regard as future developments of transnational networks, the diffusion of English as common language for trade, the improvement in legal enforcement and the development of new communication technologies, should predict a weakening in international corporate networks. On the other side, product differentiation and the importance of intangible characteristics are also increasing, asking for even more coordination and information sharing.

II.IV Purpose of the research

Despite numerous studies have posed the attention on interlocking directorates, many inconsistencies and uncertainties still remain on this field, inconsistencies that are

also reflected on the different anti-trust provisions adopted - or not adopted - by the countries all over the world. In this sense, the diffusion of transnational interlocks will probably create the need for a higher understanding of the phenomenon in order to reach a unitary treatment of IDs.

Among the three fields of literature elucidated above, it is within the second body of literature that this research is developed. The work will focus on the structure and evolution of the Italian interlocking directorates in order to understand the role played by IDs in a country that presents peculiar characteristics in terms of ownership structure, corporate governance system and state participation. This work will, therefore, try to understand how the composition and configuration of the Italian corporate network have responded over time to these peculiar characteristics and to the major changes affecting them.

Adding the results of 2011 to the previous findings of Rinaldi and Vasta (2012), will allow not only to analyze the trend of the Italian IDs over almost one century, but also to assess the effects that the latest changes, namely the economic crisis and the reform of the Italian corporate law, had in the structure of the corporate network.

Finally, a comparison with the IDs' structure in countries with different competition and corporate governance models will permit to confirm or reject the hypotheses that IDs reflect the underlying structural characteristics of the economy and that different countries are converging toward a low dense IDs network.

III. Sources and methodology

III.I Database

The data used to develop the network analysis for the year 2011 represents the 250 largest firms by total assets[1] incorporated in Italy. Information regarding firms' names, assets and state participation are extracted from *Le principali società Italiane*, the R&S-Mediobanca annual research. The dataset includes 200 non-financial firms and 50 financial firms, with the exclusion of companies 100% owned by another firm represented in the sample. An adjustment has been made in collecting the 50 financial firms: simply considering the total assets, the sample would contain only banks. In order to have a more representative sample, 25 banks and the 25 largest firms in the sector of insurance, leasing and factoring have been included. The names of the boards' members were taken from the Consob website for companies listed on the stock exchange, and from Infocamere - the Italian Chamber of Commerce dataset - for the remaining firms.

Decisions on the sample's composition are driven by the desire to obtain results comparable to those of the previous studies of Rinaldi and Vasta (2012). However, an important difference regards the inclusion of the members of the supervisory board for companies adopting the dualistic model of corporate governance. This choice reflects the 2003 reform of the Italian corporate law that allocated more powers to the supervisory board of companies adopting the dualistic board model. As we will see in Chapter V, with the reform of 2003 companies can choose among three different models of corporate governance: the traditional, the dualistic and the monistic model. For those companies adopting the dualistic model, members of both Consiglio di Sorveglianza

[1] According to the financial statement closed on 31 December 2011 or, alternatively, on the closest date.

and Consiglio di Gestione are included. The Consiglio di Sorveglianza, besides the functions commonly allocated to the supervisory board, has in fact some additional powers traditionally allocated to the board of directors. Moreover, research investigating IDs in countries adopting the dualistic board model usually includes also members of the supervisory board. The choice will therefore lead to have comparable results with those obtained in Germany.

III.II Social network analysis techniques

In order to investigate the structure of interlocking directorates at the end of 2011, social network analysis techniques have been applied to the sample using Pajek program. In this thesis, the focus of the social analysis is the ties between firms. Social network analysis assumes in fact that ties among organizations are important channels of information flows and behavioral transmission.

In developing the study of the network, both numerical and graphical social analysis techniques have been applied. The graphical representation of the network's structure is called *sociogram* and it is composed by vertices - also called nodes or points - corresponding to firms, and lines - or ties - representing the relations between two firms.

To conduct the analysis, neither the directionality neither the strength of the link has been taken into account. The directionality depends on the relative position of the interlocked director in the firms in which she/he sits and goes from the firm in which the director holds a higher position (e.g. executive director) to the one in which she/he holds a lower position (e.g. non-executive director). Excluding the directionality, the lines connecting firms take the technical name of *edges* and the resulting sociogram is

called *undirected graph* (Batagelj et al, 2011).

The strength of the link represents instead the number of directors shared by two companies: the higher the number of common directors, the higher the strength of the tie. Excluding the strength, the sociogram does not display multiple lines but only single lines with a value equal to the number of shared directors.

These choices lead to some limitations. The most important is related to the study of the relation between two interlocked companies. In fact, by excluding the directionality we exclude the information about the relative importance of two linked companies, information that can be helpful in interpreting the type of the relation between the interlocked firms. The exclusion of the strength instead, does not lead to particular informational losses: multiple lines are in fact substituted by single lines with a value corresponding to the number of shared directors. The number of multiple lines can be therefore easily computed counting the number of lines with value higher than 1.

These choices have been driven by three main technical reasons. First of all, the exclusion of multiple lines consents to compute the density, which does not take into account the number of common directors, but only the number of firms with which a certain company is tied. Secondly, it permits to obtain results comparable to those of other studies, as these two assumptions have been adopted by the majority of the scholars. Thirdly, the exclusion of multiple lines is required by the type of network represented by our sample. The network we are analyzing is in fact a two-mode network and presents specific differences with respect to the traditional one-mode network. In a one-mode network, the analysis focalizes or on the links between firms or on those between directors. By contrast, we are analyzing an affiliation network in which directors are connected to the boards of different firms and it is the affiliation of

directors to the firms that create ties between companies. This type of network leads to a number of complexities, not last the huge number of information that each time must be elaborated. Therefore, firstly a two-mode network was created in order to relate each director to the companies in which he/she seats. Then, the two-mode network has been transformed in a one-mode network of interlocking firms in order to extrapolate only the relationships between companies sharing at least one director. In this process, multiple lines were replaced by a single line - valued network - with the line values indicating the original number of lines between two firms.

Once the one-mode network was created, the first step was the analysis of the cohesion. In order to do so, the following measures have been developed.

- *Density*. "Density is the number of lines in a network, expressed as a proportion of the maximum possible number of lines" (Batagelj et al, 2011).

$$D = \frac{L(r)}{L(p)}$$

Where, L(r) is equal to the number of real lines and L(p) to the total number of possible lines and is determined by $L(p) = n(n-1)/2$.

The density ranges from 0, if no ties link the firms in the network, to 1, when all pairs of firms are linked by an edge. Intuitively, density is inversely related to the size of the network: the higher the number of firms included in the sample, the lower the density because the number of possible ties increases, while the number of relations that each firm can maintain is limited. For the purpose of the measurement of the density, both multiple lines and line values are not taken into account.

- *Average Degree*. The degree of a vertex, in our case, is the number of firms to which a firm is tied. The degree is therefore computed for each vertex, not for the

entire network, and only after, the average is computed. The average degree is an important measure of the structural cohesion of the network especially for comparative analysis because it does not depend on the size of the sample.

- *Components.* Components are subgroups of the network within which each company included in the subgroup is connected with at least another firm of the same subgroup, and none of the firms of the subgroup is connected with a firm outside it. Components are therefore defined as the "maximal connected sub-network" (Batagelj et al, 2011). Components can be interpreted as cohesive subgroups and will be studied taking into account their number and the number of firms included in them. Some researchers consider components a sub-group with at least three firms. However, in this research also sub-networks with only 2 firms have been considered components. This choice reflects the methodology adopted by Rinaldi & Vasta in their works, works to which this thesis refers for trend analyses.
- *Cores*. "A k-core is a maximal sub-network in which each vertex has at least degree k within the sub-network. K is therefore the minimum degree of each vertex to be part of the core" (Batagelj et al, 2011). Usually, k assumes a value equal or higher than 2, in order to identify highly dense and cohesive sub-groups within the network.

The measures of cohesion permit to draw the general structure of the network in order to understand how information and goods will probably flow within it. However, it is also possible to focus on the position held by specific firms. The analysis of actor centrality is therefore conducted to understand the position and the relative power of specific firms within the network, in terms of access to information, ability to spread

information and role in connecting other firms. Three are the measures used.

- *Degree Centrality*. The centrality depends on the number of other firms to which a firm is directly tied; therefore, the degree centrality of a firm is simply its degree.
- *Closeness Centrality. "The* closeness centrality of a vertex is based on the total distance - the number of steps or intermediaries needed for someone to reach another person in the network - between one vertex and all other vertices, where larger distances yield lower closeness centrality scores" (Batagelj et al, 2011). It is computed dividing the number of the other vertices by the sum of all the distances between the vertex and all the others. This measure allows taking into account not only the number of other firms to which a company is tied, but also the position and the role played by such firms. For obvious computational reasons, this measure cannot be computed if the network is not completely connected. To overcome this problem, the closeness centrality has been computed only with reference to the main component.
- *Betweenness Centrality*. Both degree and closeness centrality are based on how easily reachable a firm is. A different approach to centrality lies on the idea that a firm is more central if it has an important function in intermediate the network. A high betweenness of a firm is associated with a high role of this firm in facilitating the flow of information within the network and its removal would break the flow of information. The betweenness centrality of a vertex is represented by the proportion of all geodesics - shortest paths - between the pairs of other vertices that include this vertex.

After getting the general structure of the network, a partition analysis was conducted in order to understand which sectors are more connected and which others

tend instead to remain more isolated. To do so, the sectors of activity have been used as attributes to create partitions. “A partition of a network is a classification or clustering of the network’s vertices [in which] each vertex is assigned to exactly one class (or cluster)” (Batagelj et al, 2011). In our case, this means that each firm - vertex - can be associated only to one sector of activity - class. Then, in order to provide a graphical representation of the sectors’ position within the network, a different color has been associated to each sector of activity (Figure 2).

Finally, relying on the fact that partitions divide firms in a number of mutually exclusive subsets, those partitions have been used to shrink each group of firms belonging to the same sector into a new vertex. This technique is called “global view” because by replacing firms with sectors, it allows zooming out and highlighting only the ties between different sectors. The resulting sociogram fosters the comprehension of the position assumed by different sectors within the network (Figure 4).

IV. Top 250 Italian firms: structure in a long-term perspective

Table 1 provides general statistics of the 250 top Italian companies' structure at the end of 2011. The total number of seats is 2472, corresponding to an average size of the board of 9.9. From Table 1 we can see that the size of the board is remarkably different between financial and non financial firms, with financial companies having a larger board of directors, with an average of 13.7 members, than industrial firms, where the mean number of board members is 8.94. This large difference is not limited to 2011. Table 1 shows that the average size of the board has been larger in financial companies than in non-financial firms for all the period investigated. Interestingly, while starting from 1972 the total number of seats constantly decreased, from 2001 to 2011 they seem to rise again. However, this increase can be misleading: while for the benchmark years from 1913 to 2001 only the members of the board of directors are included, in 2011 for companies adopting the dualistic model of corporate governance, members of *Consiglio di Sorveglianza* are included as well. The increase in the average size of the board is, therefore, not only due to an increase in the size of the board of directors, but also to an increase in the number of people with influence on company's choices. Moreover, the presence among the top non-financial firms of 13 cooperatives which have, in general, a larger board of directors, is remarkable. Correcting for both the members of the supervisory boards and the cooperatives, the average size of the board is 8.9, slightly lower than that of 2001.

Table 1 shows that in 2011 the 2153 directors hold 2472 positions. This corresponds to a cumulation ratio[2] of 1.15. It is interesting to note that both the

[2] The cumulation ratio is equal to the total number of seats divided by the total number of directors.

cumulation ratio and the percentage of multiple directors are higher for non-financial firms than for financial firms, denoting that interlocks among non-financial companies are more frequent than interlocks among financial ones. Financial firms are in fact more inclined to interlock with non-financial companies rather than within their sub-group, especially after the new law restricting interlocks between financial companies (Manovra Salva Italia, 2011). This is confirmed by the fact that the statistics for the total sample are higher than the measures for the single sub-groups. If we analyze for example the number of multiple directors, in total 233 directors cover more than one position. However, the number of multiple directors in non-financial and financial firms is only 186 (Table 1). This result reflects the presence of interlocking directorships between financial and non-financial firms: 47 directors, even if not creating interlock among companies in the same sub-set, have the function to interlock financial firms with non-financial companies.

Table 2 summarizes general statistics of the top Italian firms for 8 benchmark years: 1913, 1927, 1936, 1960, 1972, 1983, 2001, 2011 using, for years previous to 2011, data provided by Rinaldi and Vasta (2012). The cumulation ratio (CR) of the total sample steadily decreased from 1927 onwards (Figure 1). Similarly, the average ID per firm dropped from 21.4 in 1927 to 0.9 in 2011, with the only exception of 1960 when the average ID was 14.1, 0.6 points higher than in 1936.

Analyzing the difference between non-financial and financial firms, non-financial firms have always registered a higher cumulation ratio for all the benchmark years with the only exception of 2001, when the CR was higher for financial firms. Interestingly, while the CR among non-financial firms has assumed a downward trend from 1936 onwards, the CR among financial firms remained more stable, at least until 1972 when

ups and downs started to alternate, and reached its peak only in 2001 before decreasing of 0.15 pints in the last decade.

An important distinction that should be drawn in order to provide a clear and representative description of the structure of the top Italian firms is the one between state-controlled and private firms. Given the variety of forms that the state participation can assume, to classify companies between private and state-controlled we exclusively rely on the information provided by the R&S-Mediobanca. In 2011, the state holds a dominant participation in 35 out of 200 non-financial firms, while none of the financial companies is state-controlled (Table 1). The influence of the state in the economy started to emerge in 1927 and reached its peak in 1983, when 85 companies out of 250 were controlled by the state (Table 2). From 1983 onward, the role of the state in the economy started to decline. Yet, despite the massive privatization processes of the 1990s, in 2011 the state still controls 17.5% of the top non-financial firms. Most interestingly is the role played by state-controlled firms: of the 35 companies controlled by the state, 11 are among the top 20 non-financial companies and both the top two non-financial firms by total assets, ENEL and ENI, are state participated. These evidences reveal that despite the number of state-owned firms drastically diminished from 1983 to 2011, the state continues to play an important role in the Italian economy, by retaining the control of the major companies.

Table 3 shows the sector of activity of the top 250 Italian firms. As stated in the previous section, for the 50 financial firms only 25 banks are included even if a ranking by asset would lead to a larger representation of the banks in the sample. The other 25 financial firms include, by order of importance, insurance, leasing and factoring companies. Another adjustment has been made for the holding companies: holding

companies have been classified according to the main sector of activity of the controlled firms, except for six of them, for which the identification of a unique sector of activity is restrictive. These six companies are classified as "holdings", a group that does not appear in previous studies.

The most represented sector in 2011 is the manufacturing industry. This result is in line with previous findings of Rinaldi and Vasta (2012): the manufacturing sector has in effect been the most represented sector for all the benchmark years (Table 3). However, the number of the manufacturing companies in the top Italian firms dropped considerable from 1972, when they represented 59% of the total sample, to 2011, when the manufacturing sector included only 39% of the companies. Conversely, the growing relevance of sectors that have traditionally maintained a marginal role such as services, warehousing and trade is remarkable. Together, these sectors now represent 24% of the top non-financial firms, signaling a general shift of the Italian economy away from the secondary to the tertiary sector.

The sector showing the biggest change across the years is the utility industry, within which electrical companies have been strongly affected over the years by state intervention. The electricity industry was nationalized in 1962 by a law granting ENEL the monopoly in the various phases of the value chain, from the production to the distribution and sale. This nationalization was accompanied by a consolidation process, decreasing the number of firms in the utility sector, which dropped from 46 in 1960, to only 5 in 1972. The number of electrical companies remains low until the 1990s; the privatization was in fact completely reached only in 1999, when Italy implemented the European Directive 96/92/CE. As a result, the number of firms included in this sector increased from seven in 1983 to 41 in 2001 (Table 3). However, Rinaldi and Vasta

(2012) include also telecommunication firms in this category. This sharp increase should, therefore, be read more as a result of the internet boom and the consequent proliferation of telecom companies - also responsible for providing internet services - than as an increase in the number of electrical companies. In fact, due to the high investments necessary to compete in the electrical industry, companies that effectively enter this sector after the privatization were few and at the beginning of 2012 ENEL, still participated by the State, remains the largest electrical firm and also the biggest Italian non-financial company by total assets. Following this reasoning, the new recent decrease in the number of utility companies, which in the last decade have dropped from 41 to 25, can be read as a consequence of the end of the internet bubble and the effect of the financial crisis on the telecommunication sector.

The last interesting aspect to underline is the corporate governance model adopted by the top Italian companies. Although the reform of 2003 allows companies incorporated as *Società per Azioni* to choose between three forms of board model, only seven of the 250 largest Italian firms opted for the dualistic model - four banks and three non-financial companies - and none of them for the monistic one. The dualistic model was introduced to allow Italian companies to adopt a corporate governance system more similar to the one of Germany, given the frequent business relationships linking Italian and German companies. Not surprisingly, the only foreign company adopting the dualistic model is Deutsche Bank SpA.

V. Italian corporate law

This work is about the Italian interlocking directorates: their structure, evolution and interpretation are the main purposes of the research. However, interlocking directorates have a strong impact on the effectiveness of the corporate governance system and are in turn affected by it. Moreover, as explained in Chapter III, the choice of the sample reflects in part the 2003 reform of corporate law, and also the interpretation of the trend is in part linked to the new rules in terms of corporate governance. Therefore, this paragraph provides a general overview of the Italian corporate laws, focusing on two aspects of the corporate governance system: the different board models and the limits to positions' accumulation.

V.I The reform of 2003

The main sources of the Italian corporate law are represented by the Civil Code, the Consolidated Act on Finance of 1998, the regulations issued by the Consob[3] and the Italian Stock Exchange, and finally by the Code of Conduct[4] - *Codice di Autodisciplina* - which does not contain binding provisions but is applicable through a "Comply or Explain Rule" (Bruno & Ruggiero, 2011). Despite many sources of corporate law have been enacted in the last fifteen years, they have mainly concerned the companies listed in the Sock Exchange. As a consequence, the Civil Code issued in 1942 continues to play a central role because it proves the basic legal framework applicable for every type of firms.

The Civil Code has been profoundly revised, for what concern corporate law, by

[3] Italian authority entitled for the supervision of securities markets.
[4] Issued in 1999 and revised in 2011.

the reform of 2003 enacted with the main purpose to give a strongest international and managerial look to Italian companies, historically dominated by large shareholders and characterized by weak separation between ownership and control. With this aim in mind, the biggest change introduced by the reform regarded the corporate governance system (Bruno & Ruggiero, 2011).

Before the reform, the only possible form of corporate governance was a two-tier horizontal model, with the shareholders' general meeting appointing both the board of directors - *Consiglio di Amministrazione* - and the supervisory board - *Collegio Sindacale*. After the reform, companies adopting the form of *Società per Azioni* can choose among three different forms of board model: the traditional model existent before the reform, the dualistic model and the monistic model.

The dualistic model, also called two-tier vertical model (Bruno & Ruggiero, 2011), tries to reflect the corporate governance system typical of Germany. The general meeting of shareholders appoints the supervisory board - that under the dualistic model took the name of *Consiglio di Sorveglianza* - which in turn appoints the board of directors - called *Consiglio di Gestione*. Under the dualistic model, therefore, is the supervisory board, instead of the general meeting of shareholders, to have the power to appoint the members of the board of directors.

Finally, under the monistic model - one-tier board model (Bruno & Ruggiero, 2011) - only one board is present: the board of directors. The board of directors is appointed by the general meeting of shareholders and the board itself chooses, among its members, those who will form the supervisory board – *Comitato per il Controllo sulla Gestione*.

It is evident that the two alternative board models, dualistic and monistic, present

a different allocation of powers between shareholders and boards: while in the traditional model the general meeting of shareholders appoint the two boards, in both the dualistic and monistic models, shareholders appoint only one board, reducing their influence on the company's management. The same difference regards the power to dismiss boards' members. In line with the power of appointment, in fact, in the dualistic model the supervisory board, and not the general meeting of shareholders, is in charge to dismiss the members of the board of directors. The differences in the allocation of powers extends also other aspects, such as the approval of the financial statement that in the traditional model is allocated to the general meeting of shareholders while in the dualistic model to the *Consiglio di Sorveglianza*.

For the purposes of this thesis what is important to note is that the *Consiglio di Sorveglianza* has more powers than the traditional powers allocated to the supervisory board and consequently exercises, through the appointment and the dismissal of the members of the board of directors and the approval of the financial statement, a higher influence on directors' choices. This higher influence is therefore at the basis of the decision to include, for companies adopting the dualistic model, also the members of the supervisory board.

V.II Limits to functions accumulation

The relevance of interlocking directorates within a country is inevitably influenced by the presence of regulations restricting functions accumulation. The presence of this type of regulation reflects in turn the existence of a concern of the legislator related to the issue of interlocking directorates, which can be insightful in the interpretation of the possible effects of IDs. Interestingly, legislators all over the world

have adopted different approach to interlocking directorates.

In the US, the major concern of the legislator has always been the free competition and the ability of IDs' to distort it. The Clayton Act of 1914 and the Interlocking Directorates Act of 1990, prohibiting interlocks between competing firms, reflect such fear.

In Europe, instead, the major concern of the legislator has traditionally been linked to the effectiveness of the members of the boards. As a consequence, the main purpose of the regulations issued in Europe has traditionally been that of ensuring "enough time" spent by directors within the companies in which they hold a position. Even in UK, a typical example of liberal market economy, only the Corporate Governance Code - which is not binding - deals with the issue of functions accumulation. In particular, the Corporate Governance Code states that directors must have "enough time" to work in the organizations in which they have been appointed, but leaves to each company the power to quantitatively define what "enough time" means.

In Italy, the Consolidated Act on Finance of 1998 was the first law limiting directors of listed companies to cumulate functions in many organizations. Like the UK Corporate Governance Code, however, the Consolidated Act (t.u.f.) left to companies the responsibility to auto-determine this limit. To overcome the problems that intuitively can result from this type of regulation, the subsequent article 148 bis of t.u.f. delegated to the Consob the power to fix specific limits, taking into account both the complexity of the positions held and the size of the companies involved. As a result, two restrictions have been set:

1) Members of the supervisory board of a company listed on the stock exchange cannot hold this position in more than five listed companies (Art. 144 terdecies, 1°

co. Reg. emit.);

2) Members of the supervisory board of a company listed on the stock exchange, cannot hold other positions in other corporations if the total "weight" of such positions (calculated on the basis of a particular methodology determined by the Consob) is higher than six (Art. 144 terdecies, 2° co. Reg. emit.).

As the aforementioned points illustrate, specific restrictions have been fixed only for the members of the supervisory board[5] of listed companies, leaving the power to fix the limits of accumulation of positions within board of directors still at the discretion of each company. However this pattern is progressively changing and a greater attention toward the possibility of anti-competitive effects of IDs is emerging also in Europe. The EU recognized in fact the need to pose fixed limits common for all the European countries.

Even if these restrictions does not still exist at European level, in Italy this new concern is reflected in the *Manovra Salva Italia* that in 2011 posed new limits for functions accumulation in financial firms. The *Manovra Salva Italia*, also called the "Interlocking Ban", explicitly forbids to the members of the board of directors and of the supervisory boards of financial firms and to top level managers of financial firms to exercise similar functions in competing companies.

This different concern is also reflected in the latest approach of the European Commission when approving mergers and acquisition processes. In fact, more and more often the EU makes the approval of an M&A processes dependent on the breaking of interlocking directorates with other competing firms. Exemplary was the case of the acquisition of INA by Generali Assicurazioni in 2000. The acquisition process of these

[5] Such limits apply independently to the board model adopted.

two insurance companies was allowed by the European Commission only after the members of the board of directors of Generali left the board of directors of other insurance firms. Similar examples happened both in Italy – Fondiaria/Sai, Allianz/Toro, Unicredit/Capitalia - and abroad - Allianz/Dresdner, Nordbanken/Postgirot. According to the European Antitrust Commission, in fact, it was not the M&A process per-se to alter the competition, but instead the "structural and/or personal links between competitors"[6].

Interestingly, while regulations issued until 2010 were exclusively focused on granting directors' ability to dedicate "enough time" in exercising their functions, the latest regulations seem to be moved by a new concern related to the fact that interlocking directorates can ultimately alter the competition. This new approach can therefore be read as the confirmation of the theory according to which IDs may allow companies to coordinate their activities, leading to collusion and ultimately to a distortion of the markets.

The following sections reveal whether and how this new approach of the legislator on the issue of interlocking directorates has influenced the structure of the corporate networks both in Italy and abroad.

[6] Case M. 1712 Generali/INA; Decision of 12 January 2000; CEE.

VI. The corporate network in 2011

VI.I Network structure

Figure 2 shows the graphical representation of the network in 2011. The first feature emerging from the sociogram is the presence of eight separate components: the main component, a smaller component including four firms, an even smaller component with only three firms, and five components constituted by two firms each.

Figure 3 graphically shows that the network in 2011 is less cohesive and inclusive, with 93 isolated firms and only 56% of companies included in the main component. This is reflected in all the measures of cohesion. The total number of ties between firms is in fact considerably low for a sample composed by 250 firms. This is responsible for the low level of the overall network's density (1.02). The density of the main component, however, is more than three times higher than the density of the total network (Table 4). This result is quite expectable given the absence of other large components besides the main one. Similarly, the average degree of the main component (4.4) is much higher than the network's average degree (2.55), as shown in Table 4.

Two other important pieces information can be extrapolated from the graphical representation of the network (Figure 2): the configuration of the network and the position assumed by different industries in the network.

As explained in section III, networks can assume different shapes according to the kind of relations, the strength of cohesion and the relative power of firms included in them. If we look at the main component, the configuration that is more associable to it is the "star": at the center of the main component, a quite close group of firms are surrounded by more marginal firms which, in general, share no directors between one

another. This type of configuration allows the most central companies to dominate the "satellite" firms through an easy control over decisions and information flows (Windolf, 2002).

Interesting is also the configuration assumed by the component formed by three companies, that takes the name of triad (Batagelj et al. 2011). A complete triad occurs when all the companies are connected among them: in this situation, information tends to flow smoothly and conflicts among two members are easily solved through the intermediation of the third firm. By contrast, in the triad present in the network showed by Figure 2, one tie is missing and two companies result not to be directly linked. This configuration takes the name of "incomplete triad". Differently from the complete triad, in an incomplete triad the firm in the middle, the one that has the role to connect the two other firms that would otherwise be disconnected, has a position of advantage. For instance, it can take advantage of the competition between the two firms in order to negotiate better conditions, relaying on the fact that the other companies will not communicate without its intermediation. This has an important implication for the interests of companies in maintaining a specific tie: the higher the risk of assuming a position of disadvantage in the case the tie is broken - as in the case of a complete triad - the higher the efforts in maintaining the relation (Batagelj et al. 2011).

In our network, other examples of complete and incomplete triads can be found not as individual components but as parts of the main component.

In Figure 2, colors provide additional information: the sectors of business activity of the firms in the network. The first evident feature is that the center of the main component is mostly represented by financial companies and manufacturing firms. Moreover, all the holding companies are included in the main component, except one

holding that is part of the triad. As regard as the triad, it is formed by one holding, one manufacturing and one financial company, assuming the latter the most strategic position. Interestingly, utilities companies - that have historically played a prominent position in the Italian corporate network - do not play a central role within the main component. By contrast, a more central position is assumed by building companies and by some companies belonging to the residual sector (airway, warehousing and communication). To be noticed is also the presence of one services company at the very center of the network.

To better understand the role played by different industries, Figure 4 displays the relations between network partitions: the sectors of business activity. The first remarkable aspect is that no industry is completely disconnected. Two sectors, the shipping and the railway industry, assume however a more peripheral position, interlocking with the manufacturing sector only. The manufacturing sector results to be therefore the most connected industry, linked to all the other sectors with the exception of the tramway industry. Tramway industry is, by contrast, connected only with the building and the residual sectors. Also the trade sector presents only two relations, with the financial sector and the manufacturing industry. Differently, the most connected sectors are, besides the manufacturing, the financial and the residual sector (airway, warehousing and communication). The financial sector, in particular, holds a very central position, denoting the strategic role played by banks and insurances in connecting the whole network. Broad relationships are also maintained by holdings and utilities industries.

Figure 5 highlights the role and position of state-owned firms within the Italian corporate network. Of the 35 state-participated firms included in the sample, 11 are

completely isolated, while the others present at least one interlock. Interesting is the fact that the state has a predominant participation in all the firms included in the second largest component. Also, one of the components with two firms only is composed by two state-participated firms. State-participate firms seem to create interlocks mainly with other state-participated firms rather than with private companies. As explained in section VII, this situation emerged for the first time in 1983 when, due to the greater influence exercised by political parties over state-owned firms, the incentives for private and state-owned firms to interlock decreased.

VI.II Actor centrality analysis

Actor centrality tries to assess which firms play the most important role in the corporate network. Table 5 provides an analysis of actor centrality ranking the ten most central companies on the basis of three measures: degree, closeness centrality and betweenness centrality. Confirming previous findings, the most central sectors according to all the three measures are the manufacturing and the financial sector.

The top two positions in each ranking are occupied by Pirelli & C. S.p.A. and Atlantia S.p.A. Interestingly, Pirelli & C. S.p.A maintains equity participations in other top Italian companies, participations that in many cases overlap with the presence of interlocking ties. Altantia S.p.A., the service company at the very center of the network that was identified before, is part of the holding Edizione S.r.l. Many of the ties Atlantia S.p.A. has are between other companies in which Edizione owns a stake. Therefore, also the interlocks formed by Atlantia S.p.A. can be reconnected to the presence of share participations, albeit indirectly through the intermediation of the holding. Moreover, Pirelli and Atlantia are reciprocally linked by both cross-participations and ID ties.

The fact that two companies occupy the first position according to all the measures of centrality is remarkable because it signals that companies with the highest number of ties also assume a brokerage function in connecting firms otherwise isolated. This is the case not only for Pirelli & C. S.p.A. and Atlantia S.p.A., but also for the majority of top ten central firms. One of the exceptions is represented by Eni S.p.A. that does not appear among the most central companies according to the other measures, but still plays an important brokerage role. Eni S.p.A. is the only state-participated firm among the top central companies.

VII. One century of Italian corporate network

VII.I Structure of the network over time

Figure 3 shows that the Italian network was already highly concentrated in 1913, the first benchmark year, when 91.6% of the firms in the sample belonged to the main - and at that time the only - component. However, the highest level of concentration was reached in 1927 and in 1960. In both benchmark years, the network was structured in three components with the main component comprehending more than 90% of the firms.

Table 4 shows that in 1927 almost all the measures reached their peak. Particularly relevant is the density, which registered its record value of 8.61. After that year, the density started to decrease at a sharp rate until 1936 to slightly increase again from 1936 to 1960. However, despite the level of density in 1960 was three points lower than in 1927, the percentage of isolated and marginal firms reached their lowest level (Figure 3) signaling a highly connected network. From 1960 onward, density as well as all the other cohesiveness' measures started to decline, with the sharpest drop registered from 1972 to 1983, when all the measures almost halved. Particularly evident is the drop in the average degree that fall from 10.2 to only 5.1. After 1983 onward, the network cohesiveness continued its downward trend, but at a slower pace. The measure that registered the biggest drop after 1983 was the number of firms included in the main component: after having remained more or less stable at high levels for all the benchmark years, from 1983 to 2001, this measure declined from 209 to 153 and continued to decrease until 2011 (Figure 3).

As a result of this trend, the network in 2011 is quite disconnected, with a high

number of isolated firms (93) and a main component comprehending only 56% of total firms. However, if a general look would suggest that the network structure is simply continuing its downward trend, a deeper analysis unveils some breaking points. In particular, three aspects break the general trend.

The first is the number of multiple lines[7]. The number of multiple lines sharply decreased in the last decade and this decrease, even if expectable, was higher in relative terms than the drop in all the other measures. This means not only that more firms are isolated, but also those companies that remain connected tend to maintain only weak ties with other firms. As for interpretational purposes, a decrease in the number of multiple lines is generally associated with a change in the type of the relation linking two firms, the ties assuming more a personal than an institutional purpose. However, the fact that the sharp decrease in the number of multiple lines is not associated with a comparable decrease in the firms connected in the 2-m cores network signals that the links most frequently broken are those between companies sharing a higher number of directors, rather than those between companies already weakly tied. This tendency seems to reflect more a strategy of the interconnected companies than a personal choice of directors.

The second aspect breaking the trend is the number of components. Table 4 shows that for all the benchmark year previous to 2011, the number of components is inversely related to the other measures of cohesiveness. As a consequence, a rise in the number of components with a decrease in the number of firms in those components would be expected, as a signal of fragmentation. Instead, form 2001 to 2011 the number of components decreased from 12 to 8. This situation can indicate the incapability of the

[7] Even if the strength of the link has not been considered for the purpose of this analysis, the number of multiple lines has been extrapolated by isolating all the lines with a value higher than one.

firms outside the main component to create a link with another isolated firm without being part of the largest and highly centralized main component. As a result, even if less connected than in 2001, the network in 2011 is less fragmented.

The third aspect to be particularly interesting is the diameter. The diameter represents the shortest path among the two most distant firms. Looking at previous data, the diameter has always been inversely related to the other measures of cohesion: the more disconnected the network is, the more paths the information has to cross to reach its final recipient. We would therefore expect an increase in this measure. Surprisingly, in the last decade the diameter decreased from 11 to nine, signaling that the information should cross nine firms, instead of 11, to reach the two opposite sides of the main component. This circumstance may suggest that the firms which exited from the main component in the last decade were mainly the most marginal firms, while those with a highest closeness centrality remained linked in the main component. This interpretation would confirm the previous hypothesis that the overall network, even if more disconnected, is less fragmented than in 2001.

VII.II Explanation of the trend

As explained in the previous paragraph, the Italian corporate network was already highly dense in 1913, year in which a concern about interlocking directorates emerged for the first time. Starting from 1913, the cohesiveness almost doubled in 14 years, reaching its peak in 1927. However, the network's connectivity does not remained so high for a long period and in 1936 all the measures were only slightly higher than those of 1913. From 1960 onward, a sharp decrease in the cohesiveness was registered.

The aim of this paragraph is therefore to explain why those variations happened

having regard, in particular, to the effects that structural changes in the Italian economy and corporate governance system had on the corporate network cohesiveness.

Many scholars relate the structure of the Italian interlocking directorates' network to the role of the state in the economy. Figure 6 provides a graphical representation of the density - used as a proxy for the overall cohesion - and the number of state owned enterprises. The graph shows that the state intervention has positively affected the network's density in the periods from 1913 to 1927 and, then, from 1983 to 2011; instead, from 1927 to 1983 the two variables seem to be inversely related.

The period from 1913 to 1927 corresponds to the first period in which the state started to consistently intervene in the economy, especially in the agricultural sector and in the building and railways industries. This period also corresponds to the greatest diffusion of the mixed banks - the Italian banks on the style of the German universal banks. Through the concession of long-term credits to private firms, mixed banks played an important role in financing and sustaining the Italian industrialization process at the beginning of the Twentieth Century (Rinaldi & Vasta, 2012). As Carroll and Fennema (2002) suggest, it was probably the long-term commitment to industrial firms together with a lack of an effective supervision and judicial system that led mixed banks to establish a different type of control over firms' operations. Not surprisingly, banks were in this period at the center of the Italian corporate network.

From 1927 onward, despite the relevance of the state intervention in the economy continued to increase, the density registered a sharp decrease. In this period the state created IRI - Istituto per la Ricostruzione Industriale (1933) – in order to take over mixed banks in crisis and consequently also their participations in industrial firms. It was this incorporation of private banks and their assets to IRI that determined the

peculiar larger presence of the Italian state in the economy. This period was also characterized by another important breakthrough in the financial system: the abolition in 1936 of the *banca mista* in favor of the specialization principle that determined the separation between financial and industrial firms. Therefore, the aforementioned sharp reduction in cohesion should be read as the natural consequence of the end of strong ties between banks and non-financial firms rather than as the negative effect of the state intervention in the overall connectivity of the network. In effect, the strong intervention of the state in the economy and the creation of interlocks between SOEs and private firms prevented an even sharper disintegration of the network (Rinaldi & Vasta, 2012). As a result, the center of the network was in this period occupied by large electrical groups and, for the first time, by SOEs. Many factors fostered the interests of both SOEs and private companies to interlock: private investors continued to own equity participations in SOEs, the management in charge before the nationalization was retained, and cartels and agreements established with private firms continued to remain in place even after the nationalizations (Rinaldi & Vasta, 2012).

From 1936 to 1960, the connectivity of the network slightly rose again. In this period, the state intervention in the economy was characterized by the creation of ENI in 1953. Also, the incentives for SOEs and private firms to interlock remained high and the centered of the network was still held by SOEs and electrical companies.

However, the nationalization of the energy sector in 1962 marked an important breakthrough that led to the beginning of the disintegration of the Italian corporate network (Rinaldi & Vasta, 2012). As a consequence, large electrical groups disappeared from the center of the network, and financial companies, together with industrial firms and state owned enterprises, regained in 1972 a central position.

From 1972 to 1983 the density continued to decrease and in the year in which the presence of the state in the economy reached its apex, the network's density was less than half the one registered in 1913, in absence of the state intervention. However, the year 1983 marks an important difference with respect to 1972 because it signs the exit of SOEs from the center of the network. The economic crisis caused, in fact, many state-owned enterprises to register great losses in the period of 1972-1983. In this context, the state agreed to buy the shares that private shareholders still held in SOEs, subjecting SOEs to a greater influence from political parties and reducing the incentives for private companies to interlock with the now entirely state-owned firms (Rinaldi & Vasta, 2009). On the other side, the new era of information technology required non-financial firms to create industrial districts and to seek more flexibility in their structure, flexibility that would be hampered by the presence of IDs with SOEs. As a result, the network in 1983 was much more disintegrated than 11 years before with manufacturing firms holding the central position.

From 1983 onward, the state intervention started to decline, especially after 1990, when large privatization processes where approved. Simultaneously, the network cohesiveness continued its downward trend, but at a slower rhythm. This can be in part explained by the asymptotical function, but in part can be associated to the reintroduction in 1993 of universal banks in the Italian banking system, which can have fostered the establishment of new ties between financial and non-financial sectors. This period also corresponds to the disappearance of state-owned banks and the dismantling of IRI. As a result, the most central firms in 2001 were banks and telecommunication companies.

The causes for the decreased cohesion in 2001 and 2011 must therefore be

searched in factors different from those responsible for the weakening of the network after the 1972. First of all, the reduced importance of the domestic market for many Italian firms, in contrast to a greater attention toward export, can have acted as a disincentive to national interlocks.

Secondly, the Consolidated Act on Finance, enacted in 1998 to grant a more effective corporate governance system, introduced for the first time in Italy limits to functions' accumulation. Even if this law applies, as Chapter V explains, only to companies listed in the stock exchange and clear numerical limits have been fixed only for the members of the supervisory board, this new attention of the Italian legislator over the issue of interlocking directorates may have discouraged the creation of new interlocks.

Thirdly, the *Manovra Salva Italia* of 2011 introducing new explicit IDs restrictions for financial companies, have legally hindered the formation of interlocks among financial firms. This new regulation may also explain the tendency, highlighted in chapter IV, of financial firms to interlock mainly with other non-financial firms rather than within their sub-group.

Finally, the new approach of the European Commission to the presence of IDs when deciding for merger and acquisition processes may have the ultimate effects to hamper interlocks. It is therefore interesting to see how the other European countries have responded to this changing regulatory context.

VIII. Cross-country comparisons

Figure 7 shows the average degree of the network in six countries – Italy, France, Germany, Portugal, UK and US – across four benchmark periods. These countries present important differences in terms of market economies, corporate governance system and state participation. The UK and the US are two examples of liberal market economies, while Germany is the prototype of a coordinated market economy (Hall and Soskice, 2001). By contrast, Italy, France and Portugal take on a more ambiguous position, with an economy characterized by a strong intervention of the state (Hall and Soskice, 2001).

Hall and Soskice (*Variety of Capitalism,* 2001) sustain that the importance of interlocking directorates is strongly dependent on the capital model adopted by the State. In liberal market economies the market holds the central role and interlocking directorates are seen as a way to control markets and establish dominant positions, capable to undermine the free competition over which the economy is based (Windolf, 2002). On the other hand, coordinated market economies attribute a prominent role to the firms' ability of coordination through non-market links. For example, in Germany IDs were considered as means of coordination necessary to solve market imperfection and to grant a "reasonable" profit to every firm (Windolf, 2002).

The aforementioned differences were clearly evident from the different types of laws issued at the end of Nineteenth Century. In the same time the Sherman Act prohibited cartels defined as "conspiracy against the public", in Germany the Reichsgericht ruled in favor of them and sanctioned firms acting outside cartels. Differently, in France La Loi Le Chapelier from one side made cartels illegal, while

from the other fostered the intervention of the state and its role in economic planning (Windolf, 2012). As a result, we expect to find a greater relevance of interlocking directorships in coordinated market economies, whereas the role of IDs in liberal market economies is expected to be marginal. In this sense, it is also interesting to see how the so called "State-Owned Economies" fit within this classification.

Germany has always presented the highest cohesion, followed by Italy until the 1930s. This is not surprising, given that in Germany cooperation, cartels and informal agreements were not only frequent, but also accepted and even protected by the legislator, at least until 1956 when the first German antitrust law was issued (Windolf, 2002). In Germany the average degree reached its peak in the same year the Italian corporate network registered the maximum cohesion. This can be read as the bailing-out in Germany, as well as in Italy, of many large universal banks (Windolf, 2012). In Germany, the degree remained at high levels despite the sharp decrease; on the contrary, in Italy the average degree at the end of the Twentieth Century was as low as the one of the UK, the country that shows the lowest network connectivity.

Interesting is also the evolution of the average degree in France: the general downward trend common to all the five countries for the period of 1928-1938 is broken by an increase in the cohesiveness of the French corporate network. Windolf (2012) interprets this trend as the result of a protective policy adopted by private French companies when the Front Populaire ruled and many nationalization processes started. Therefore, in France state intervention in the economy seems to have positively influenced network connectivity. However, while in Italy SOEs and private companies were part of the same component, in France private companies interlocked only among themselves, with the scope to avoid state intervention (Windolf, 2012).

The trend of interlocking directorates' cohesion in US is surprisingly. Being the prototype of liberal market economy we would expect a very low degree, instead, the IDs' cohesion in the US assumed an upward trend from 1937 onward. This increase, even if very moderate, signals a positive attitude of US companies toward interlocking directorates, especially if we take into consideration the efforts that the US Antitrust Commission traditionally made in preventing IDs formation. Even if the US and the UK are traditionally classified as liberal market economies (Hall and Soskice, 2001), US companies have a greater tendency to create interlocks than their British counterparts. An explanation of this divergence can be found in the different corporate governance models. In the US, the law grants cost reimbursement only for proxies sent by actual directors, discouraging shareholders to propose their own candidates. As a consequence, the chance that personal ties among the corporate elite influence the appointment of new directors is high.

Figure 8 highlights the average degree trend in Italy and Portugal. From 1913 to 1983, the trend in the two countries was similar, even though Portugal always maintained a lower degree. However, from 1983 onward, the reversal of the trend caused the degree in both countries to converge in 2011. Therefore, differently from what we have expected given a general downward trend registered in many European countries, IDs in Portugal are more important today than in the most of the Twentieth Century (Da Silva & Neves, 2013). This increase in network cohesiveness was promoted by three distinctive factors: the new laws that at the beginning of the 1980s allowed the private sector to invest in industries previously reserved to the state, the integration within the European Union and a greater liberalization of the economic system (Da Silva & Neves, 2013). Therefore, also in Portugal the state intervention

seems to have influenced the shape of IDs' structure. However, differently from what happened in Italy and in France, the state intervention had in Portugal a negative effect on the overall cohesion. The almost disappearance of IDs in 1983 can in fact be read as the effect of the decision of the state to nationalize the entire financial sector (1975). Similarly, the latest reforms of 1980s allowing the private sector to invest in sectors previously reserved to the state, were the main driver of an the increasing cohesiveness.

Despite the differences mentioned above, the connectivity of European networks at the end of the Twentieth Century was on average much lower than the one registered at the beginning of the 1990s, suggesting a converging trend (Windolf, 2012). This can be interpreted as the result of different forces. Firstly, the increase in the magnitude of international trade and the corresponding reduced importance of domestic markets may cause firms to lose interest to interlock with other national companies (Carrol & Fennema, 2002). An analysis of international networks would permit to understand if this development has resulted in an increase of cross-border interlocks (Kratzer and Van Veen, 2011). Secondly, changes in corporate law regarding interlocking directorates may have discouraged the formation of interlocks which in the future could be banned. In particular, the recent attention the European Commission put on this issue suggests a probable further reduction in networks' cohesion in the near future.

IX. Conclusion

The cohesiveness of the Italian corporate network varied considerably over the last century. As a result of the decreasing trend started in 1960, the Italian corporate network in 2011 is less cohesive and inclusive than ten years before.

Over time, changes in the Italian interlocking directorates' structure reflected the role played by two distinct actors. The first actor shaping the structure of the Italian IDs is represented by the mixed banks, which until the beginning of the 1930s were strongly involved in the share capital and board of directors of non-financial firms. The financial sector, and mixed banks in particular, have played a greater role than the one usually associated to it; their long-term commitment in financing private firms was in fact translated in a willingness to control debtors' companies operations also by assuming directors positions. The second one is the state, and in particular state owned enterprises, that by creating interlocks with private firms were able to maintain substantial network cohesiveness even after the exit of the mixed banks from the financial system, network that otherwise would have been completely disintegrated already in 1933.

By contrast, recent changes in corporate networks are the result of completely different drivers. In particular, the introduction of new corporate laws and the rising concern of possible anti-competitive effects of IDs - an approach that is completely new for Europe - not only explain the recent reduction in the Italian corporate network, but can predict a further disintegration of ID ties at the European level.

In a cross-country perspective, no clear conclusion can be drawn regarding the effects of state intervention on network cohesiveness; these effects seem to depend on

how the intervention is implemented. Moreover, although some differences can be identified between liberal market economies and coordinated market economies, the major driver for corporate interlocks seems to be the corporate governance model and the level of shareholder protection, as the differences between the US and the UK reveal. In this sense, the case of Italy is exemplar. Regardless of the strong state participation and inefficient capital markets, recent laws granting higher protection of shareholders contributed to the reduction of cohesiveness of the Italian IDs, which in 2011 matched the low levels of the UK.

Finally, the converging thesis stipulated by some scholars seems to be confirmed by the cross-country comparisons. Despite some exceptions registered over time in certain countries, the cohesiveness of interlocking directorates' network in all the benchmark countries is in fact lower in 2011 than in 1927.

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XI. Tables and figures

Table 1. Descriptive statistics of the network 2011.

	Total	Non-financial firms	Financial firms
Number of companies	250	200	50
Private firms		*165*	
State participated firms		*35*	
Total number of seats	2472	1787	685
Private firms		*1479*	
State participated firms		*308*	
Average size of the board	9,89	8,94	13,70
Private firms		*8,96*	
State participated firms		*8,80*	
Total number of directors	2153	1592	647
Cumulation ratio	1,15	1,12	1,06
% Multiple Directors	10,82%	9,80%	4,64%

Table 2. Descriptive statistics of the network across eight benchmark years.

	1913	1927	1936	1960	1972	1983	2001	2011
Total number of firms	250	250	250	250	250	250	250	250
Private companies	*250*	*233*	*207*	*184*	*177*	*165*	*194*	*165*
SOEs	*0*	*17*	*43*	*66*	*73*	*85*	*56*	*35*
Total number of seats	2392	3024	2546	2933	3015	2678	2263	2472
Private companies	*2392*	*2806*	*2092*	*2064*	*2081*	*1688*	*1903*	*2164*
SOEs	*0*	*218*	*454*	*869*	*934*	*990*	*360*	*308*
Mean size of the board	9,6	12,1	10,2	11,7	12,1	10,7	9,1	9,9
Private companies	*9,6*	*12,0*	*10,1*	*11,2*	*11,8*	*10,2*	*9,8*	*13,1*
SOEs	*0,0*	*12,8*	*10,6*	*13,2*	*12,8*	*11,6*	*6,4*	*8,8*
Tot number of directors	1571	1827	1618	1932	2230	2108	1850	2153
NON-FINANCIAL FIRMS								
N° of non-financial firms	200	200	200	200	200	200	200	200
Total number of seats	1781	2236	1841	2150	2106	1813	1536	1787
Mean size of the board	8,9	11,2	9,2	10,8	10,5	9,1	7,7	8,9
Tot number of directors	1166	1356	1371	1457	1641	1456	1307	1592
FINANCIAL FIRMS								
N° of financial firms	50,0	50,0	50,0	50,0	50,0	50,0	50,0	50,0
Total number of seats	611	788	705	783	909	865	727	685
Mean size of the board	12,2	15,8	14,1	15,7	18,2	17,3	14,5	13,7
Tot number of directors	554	668	592	653	761	752	602	647

Table 3. Top Italian firms by sector of activity.

	1913	1927	1936	1960	1972	1983	2001	2011
1	50	50	50	50	50	50	50	50
2	-	-	-	-	-	-	-	6
3	8	10	5	4	5	15	10	16
4	37	62	66	46	5	7	41	21
5	4	8	4	6	5	9	11	17
6	101	85	98	118	148	142	111	98
7	9	10	7	9	6	2	1	1
8	-	-	-	-	-	-	-	-
9	8	13	2	8	10	8	2	3
10	21	6	9	2	-	-	3	1
11	7	3	3	2	1	1	-	1
12	4	3	4	-	3	7	11	21
13	-	-	2	5	17	9	9	15

Legend: 1: Financial sector (banks, insurances, leasing and factoring companies); 2: Holdings; 3: Service industry; 4: Utilities (electricity, water, gas, telephone); 5: Trade companies; 6: Manufacturing companies; 7: Mining industry; 8: Oil companies; 9: Shipping industry; 10: Railway companies; 11. Tramway companies; 12: Building companies; 13: Residual (Airway, Warehousing and Communication).

Table 4. Network structure and cohesiveness over time.

	1913	1927	1936	1960	1972	1983	2001	2011
N° of components	1	3	5	3	3	5	12	8
% of firms in the main component	91,6	93,6	89,2	91,60	88,80	83,60	61,20	56
Tot number of lines	1484	2680	1693	1768	1270	657	420	319
N° of multiple lines	304	736	463	545	291	182	143	68
Density (x 100)	4,77	8,61	5,44	5,68	4,08	2,05	1,35	1,02
Average degree	11,9	21,4	13,5	14,1	10,2	5,1	3,4	2,55
Diameter	7	6	6	7	7	9	11	9
Density of the main component (x 100)	-	-	-	-	-	-	-	3,14
Average degree main component	-	-	-	-	-	-	-	4,4

Table 5a. Actor centrality: top 10 companies by degree

Degree	Firm's name	Sector	Ranking by assets
23	PIRELLI & C. SPA	6	84
21	ATLANTIA SPA	3	38
14	MEDIOBANCA SPA	1	15
13	ASSICURAZIONI GENERALI SPA	1	3
12	ITALCEMENTI SPA	6	68
12	LUXOTTICA GROUP SPA	6	69
11	AUTOGRILL SPA	3	104
11	GRUPPO EDITORIALE L'ESPRESSO SPA	13	198
10	FONDIARIA-SAI SPA	1	26
10	EDIZIONE SRL	2	31

Table 5b. Actor centrality: top 10 companies by closeness centrality

Closeness centrality	Firm's name	Sector	Ranking by asstes
23,03%	PIRELLI & C. SPA	6	84
22,43%	ATLANTIA SPA	3	38
20,59%	MEDIOBANCA SPA	1	15
20,59%	GRUPPO EDITORIALE L'ESPRESSO SPA	13	198
20,48%	ITALCEMENTI SPA	6	68
20,22%	LUXOTTICA GROUP SPA	6	69
20,22%	IMPREGILO SPA	12	102
20,01%	FRENI BREMBO SPA	6	229
19,91%	ASSICURAZIONI GENERALI SPA	1	3
19,76%	AUTOGRILL SPA	3	104

Table 5c. Actor centrality: top 10 companies by betweenness centrality

Betweenness centrality	Firm's name	Sector	Ranking by assets
7,69%	PIRELLI & C. SPA	6	84
6,53%	ATLANTIA SPA	3	38
4,08%	FRENI BREMBO SPA	6	229
3,70%	BUZZI UNICEM SPA	6	91
3,27%	LUXOTTICA GROUP SPA	6	69
3,23%	ASSICURAZIONI GENERALI SPA	1	3
2,71%	GRUPPO EDITORIALE L'ESPRESSO SPA	13	198
2,61%	FONDIARIA-SAI SPA	1	26
2,46%	ENI SPA	7	6
2,31%	MEDIOBANCA SPA	1	15

Figure 1. Cumulation Ratio's trend.

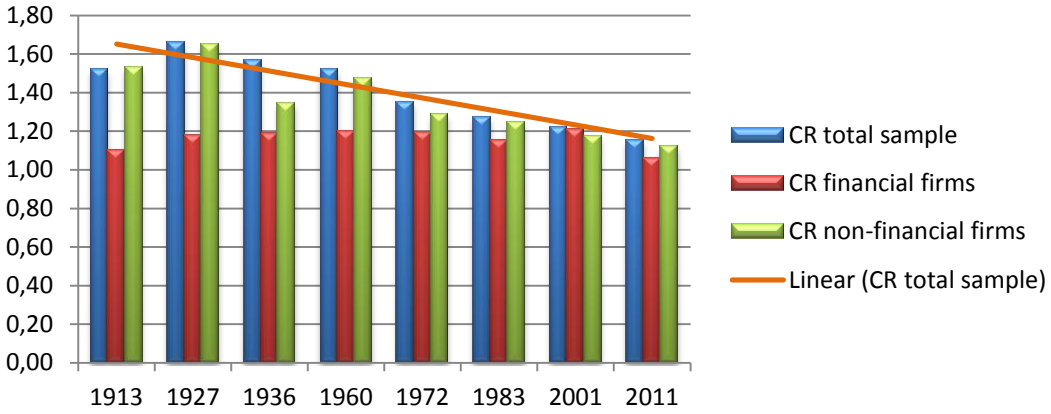
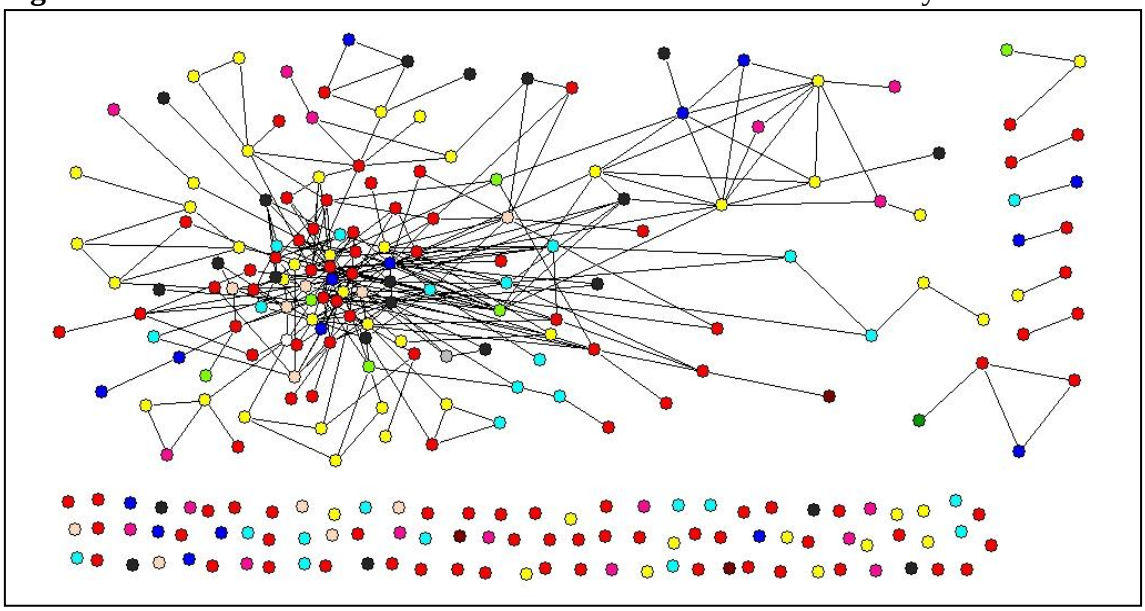


Figure 2. Network in 2011 with identification of firms' sector of activity*.



*Legend provided in the next page.

Figure 3. Network structure over time.

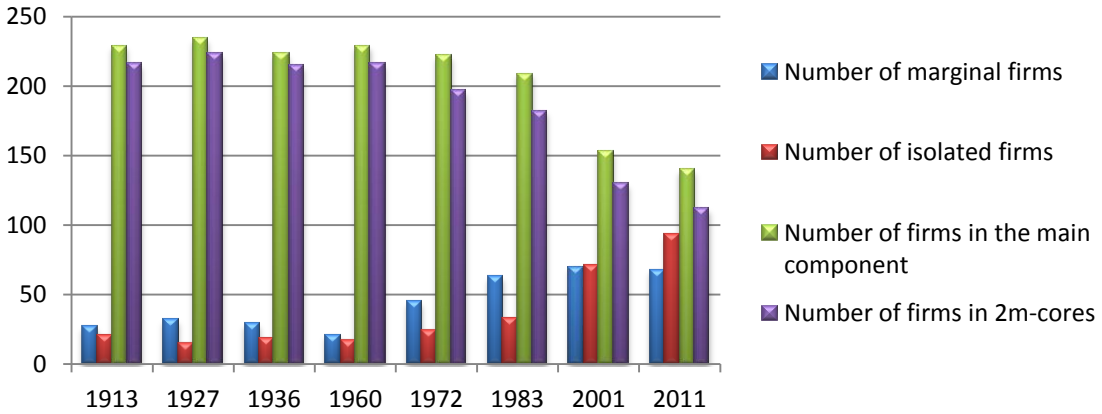


Figure 4. Relations between partitions.

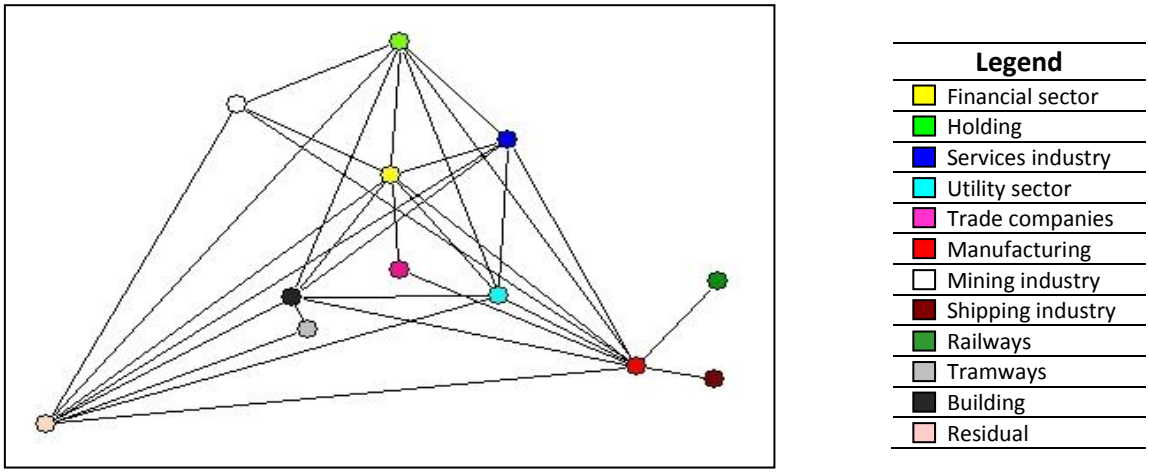


Figure 5. The role of state-participated firms in the network.

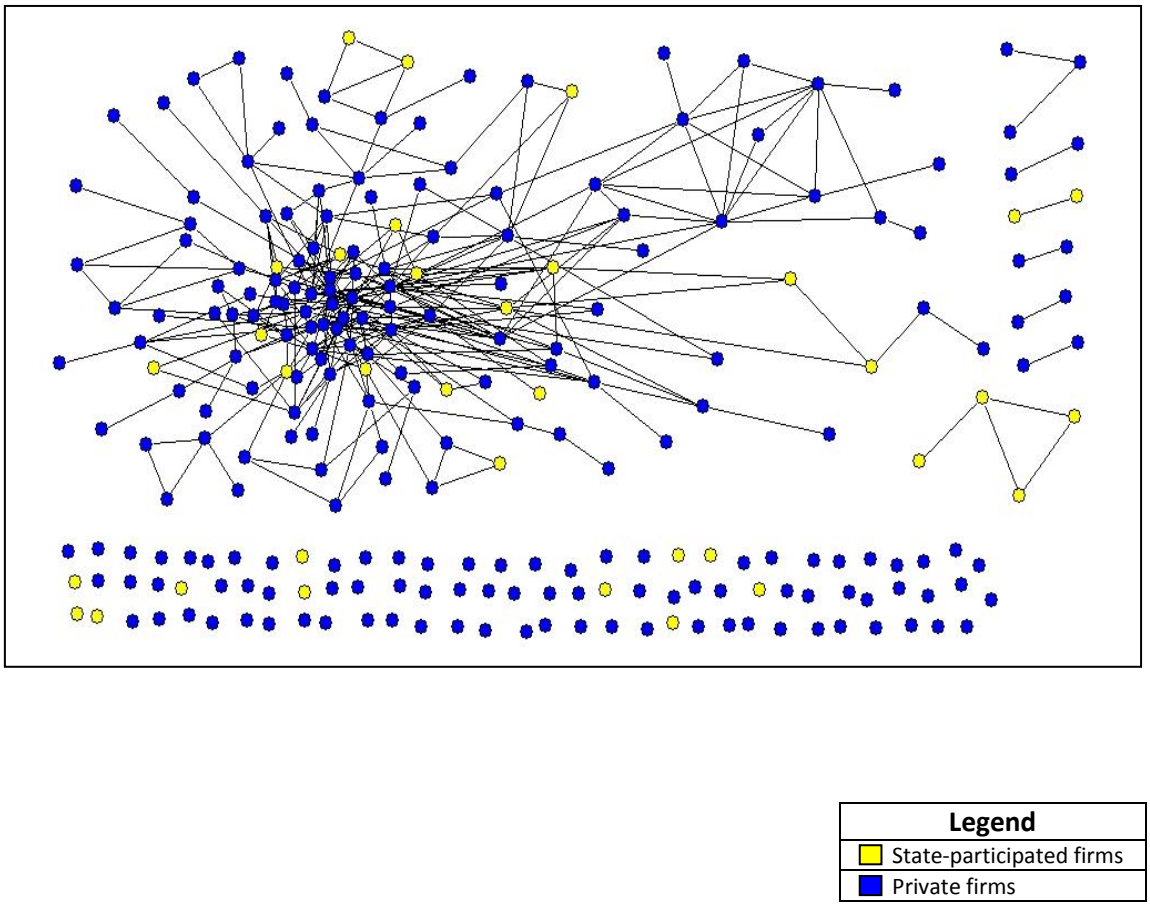


Figure 6. Relation between density and state owned enterprises.

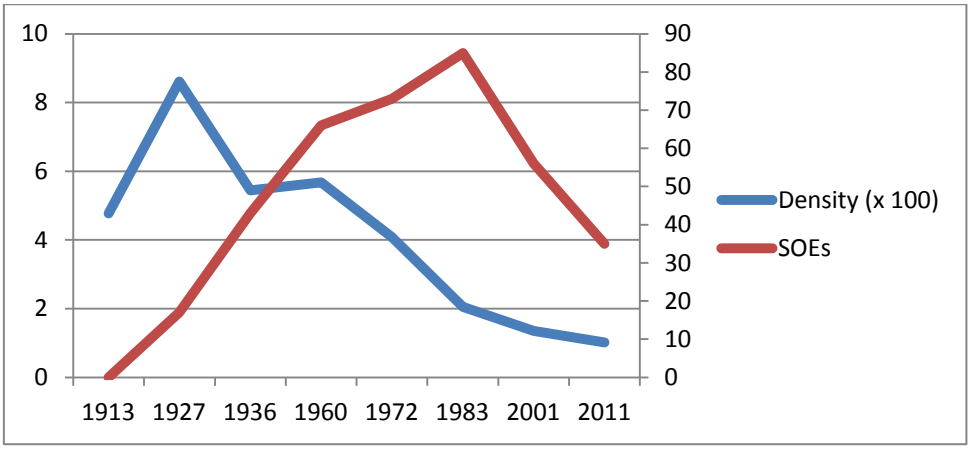
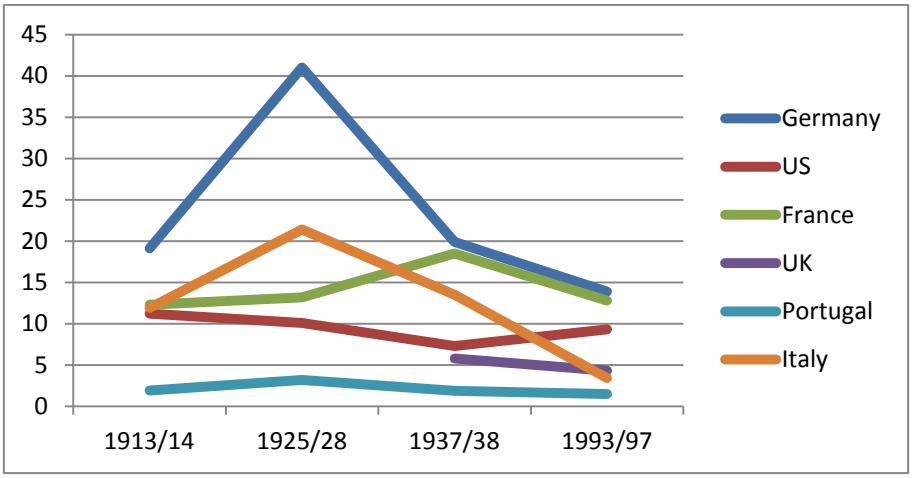
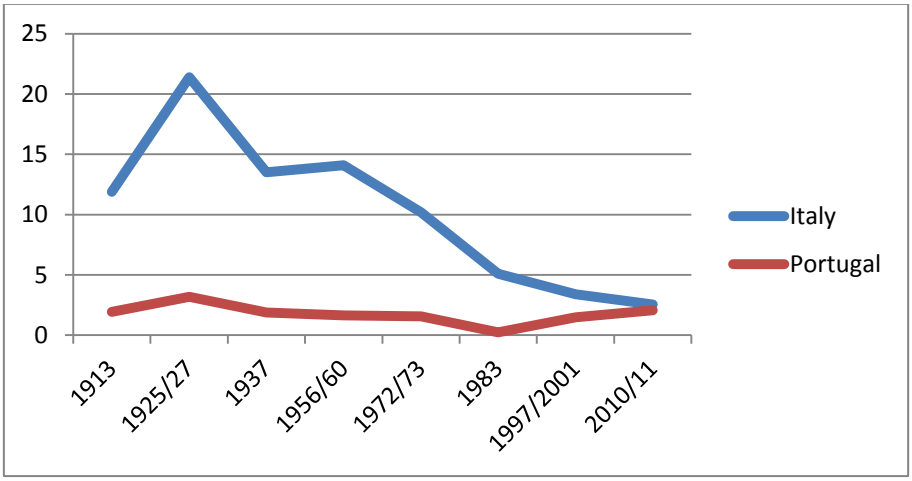


Figure 7. Average degree across countries.



*Data for Germany, US, France and UK from Windolf, 2012.
**Data for Portugal from Da Silva & Neves, 2013.

Figure 8. Network's average degree in Italy and Portugal.



*Data for Portugal from Da Silva & Neves, 2013.

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