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BOARD NETWORKS AS A SOURCE OF INTELLECTUAL CAPITAL FOR COMPANIES. EMPIRICAL EVIDENCE FROM A PANEL OF SPANISH FIRMS.

Abstract.

Purpose – Our aim in this paper is to use the dynamic capabilities framework to explain the effect of board networks, as a source of intellectual capital, on firm performance. We propose that the influence of board interlocks depends on their ability to contribute to strategic decision making. As a result, their effect is subject to the business context in which they occur and the different role of the interconnected directors involved.

Design/methodology/approach – We use social network analysis to make board connections and to calculate centrality measures. We also identify busy boards to analyse whether their effect differs from centrality. We estimate the theoretical model using the Generalized Method of Moments in order to take advantage of the panel database.

Findings – For a sample of Spanish firms from 1999 to 2015, our results show there is no direct significant effect of directors' networks on firm performance. However, we find a positive and significant influence of intra-industry board connections, particularly when they are established among outsiders.

Research limitations – The Spanish context of the study can limit the generalization of the papers' results.

Practical implications – Our results can be useful both for practitioners –since they can serve as a guide for companies to reformulate their boards in search of the optimal

structure-, and when implementing good governance codes –establishing limits for director interlocking.

Originality/value – This study helps to offer a better understanding of how directors' networks can add value to the firm depending on the kind of resources they provide (context) and the role of the director who is connected.

Keywords: board of directors, intellectual capital, network analysis, interlocking directorships, intra-industry relationships, dynamic capabilities framework.

JEL Classification: G3.

1. Introduction

It is increasingly common for countries to publish lists of the busiest directors in the leading companies. Each year, this list of directors is updated and the connections between firms through their boards are considered relevant information both for investors and financial analysts alike. In Spain, according to the news published by Europapress in May 2017, Javier Echenique Landiribar was the busiest director of the firms in the IBEX 35 during that year. He was Vice Chairman of Banco Sabadell while also holding three other board positions (Telefónica, ACS and Repsol).

When faced with this kind of news, it is surprising to think about the enormous accumulation of responsibility in the hands of just a few people. One would think that companies obviously decide to hire this type of director for their ability to add value to the company (through their relationships, experience, knowledge ...). Yet at the same time, we cannot help wondering whether they will have enough time and energy to serve all the companies to the best of their ability. These are the same contradictory arguments that have been found in academic literature since board connections -and their influence on firm performance- were first analysed.

For decades, many researchers have used the agency and resource dependence arguments to explain the effect of board connectedness on firm performance. While under the resource dependence approach, boards' networks were considered a beneficial source of resources and reputation for the firm, the agency theory has always alerted to the danger of directors possibly becoming swamped or to the possible conflicts of interest that might emerge between the companies they monitor or advise. These two sides of the same coin are reflected in the mixed outcomes to be found throughout board network literature. While some studies report a positive effect of board connectedness on firm performance (i.e. Field *et al.,* 2013; Larcker *et al.,* 2013; Li *et al.,* 2013; Omer

et al., 2014), other authors show a negative influence (i.e. Fich and Shivdasani, 2006; Andres *et al.*, 2013), whilst others offer no support in either direction (Fligstein and Brantley, 1992; Fernández-Méndez *et al.*, 2015).

In light of these contradictory results, and considering that directors continue to interlock and that firms continue to hire busy directors for their boards, there is a clear need to find an answer to some critical research questions concerning board networks that remain unanswered: is it possible to expect a general board interlocking effect on performance? If not, what kind of board networks create value for companies? Does it depend on who establishes the networks? Or does it depend on the type of firms we connect with?

To find an answer to all these questions, we propose defining the board as a source of intellectual capital and we use the dynamic capabilities framework to explain how board networks (and busy directors) need to be configured in order to create firm value. Under this framework, board capital is not defined statically as a stock of intangible resources (knowledge, experience, skills, networks…) but dynamically, as the boards' ability to derive economic benefits from these resources (Berezinets *et al.*, 2016). Following the dynamic capabilities approach, board networks are expected to have a different effect on performance depending on their ability to influence strategic decision making and help create a competitive advantage for the firm. Our arguments concerning board networks will not therefore focus on the mere accumulation of connections (number of board interlocks) but specifically on how such resources may generate economic resources -which we relate to the business context they occur in (intra-industry *vs* inter-industry networks)- and the ability of interlocked directors to use network resources effectively -which we relate to the different roles (insider *vs.* outsider) that interconnected directors play.

As regards the context, we expect intra-industry networks to generate industry-specific social and human capital (competitors, industry opportunities, entry barriers, threat of substitutes…) which will prove particularly useful for securing economic benefits since firms can use said capital to address environmental uncertainty, to respond more quickly to industry changes and, consequently, to be more ready to survive (Kor and Sundaramurthy, 2009; Haynes and Hillman, 2010; Wincent *et al.*, 2010; Lai *et al.,* 2014; Schiehll *et al.*, 2017).

In addition, we study insiders' and outsiders' networks separately since a director's contribution to monitoring and advising the firm not only depends on their skills but also on their incentives to monitor or advise (Hillman and Dalziel, 2003) and their availability time-wise to perform their duties and prepare board meetings (Fahlenbrach *et al.,* 2010; Fernández Méndez *et al.*, 2015). In this regard, outsiders are expected to have a greater incentive to monitor the executive team (Fama and Jensen, 1983). The problem concerning lack of time and energy is also expected to be more serious for insiders -who not only perform governance functions (as board members) but also management duties (as company executive) (Liu and Paul, 2015)-, than for outsiders -whose role is confined to corporate governance.

Using a sample of 102 Spanish firms listed on the IGBM index from 1999 to 2015, we find empirical support for most of these expected effects. We build on methods derived from social network analysis to characterize board networks among 2,310 directors and we evaluate each firm's position in the industry network. In addition, we examine the effect of having busy directors on the boards as a further measure to take into account when evaluating how networks impact on firm performance. Our results show no direct significant influence on firm performance deriving from its centrality in the network or the presence of too many busy directors on its board. However, when we include intra-

industry networks in the model, we find a positive and significant effect on firm performance, particularly when it is derived from outsiders' connections, supporting the notion that outsiders can use the resources from the network more effectively (they have more time, energy and incentives) than insiders.

Our contributions in this paper are both theoretical and practical. First, we propose a highly novel theoretical framework to explore the influence of board networks on firm performance. Many studies have focused on this relationship, yet as Berezinets *et al.* (2016: 635) point out, few "are devoted to the relationship between the board of directors, as a source of intellectual capital for the company, and corporate performance". By using the dynamic capabilities framework, we offer a broader and more complex perspective of how director interlocks can generate economic benefits and value creation. Indeed, according to our results, interlocks are more valuable in some contexts than in others, and some interlock partners prove to be more effective than others. Secondly, this study allows us to offer some practical recommendations for firms who are seeking the best board configuration that will enable them to continue learning and building capabilities. Our arguments are in line with the concept and development of the learning organisation provided by Senge (1990). Board networks allow directors to learn because they are an important source of information. However, according to our results, this information does not always translate into board intellectual capital since we find no evidence of a general positive effect on firm performance. Rather, it depends on the type of company that directors relate with and the people through whom connections are established.

The remainder of the paper is organised as follows. The next section reviews the related literature. We then describe the sample contextual factors, data and methodological

issues, before discussing the empirical results. Finally, the last section presents a summary of results and our main conclusions.

2. Theory and hypotheses

According to Mizruchi (1996: 271), "an interlocking directorate occurs when a person affiliated with one organization sits on the board of directors of another organization". In his paper, he also points out that there are many reasons for creating interlocks, including collusion, cooptation and monitoring, legitimacy, career advancement, or social cohesion. Since then, many authors have striven to find out not only why board networks are established, but also how they impact on performance. So far, the extensive literature on this subject has reported empirical evidence pointing in both a negative and a positive direction.

From a resource dependence view (Pfeffer, 1972; Pfeffer and Salancik, 1978), board networks increase corporate performance because they bring prestige, knowledge, experience and because they reduce their contextual dependence and uncertainty (Larcker *et al.* 2013; Li *et al.* 2013; Omer *et al.* 2014). These networks are considered part of the board's social capital (Wincent *et al.*, 2010) and their positive influence on performance has been supported by many authors (Certo, 2003; Stuart and Yim, 2010; Hillman *et al*., 2011).

However, using the agency theory (Jensen and Meckling, 1976; Fama, 1980), excessive use of board connections has been seen as problematic. When directors become over-committed, the likelihood of conflicts of interests increases (Li *et al*. 2013) and they might also be unable to devote enough time and energy to monitoring managers (Kaczmarek *et al*. 2014). Many previous papers evidencing this harmful effect of

excessive board interlocks on firm performance can also be found (Fich and Shivdasani, 2006; Andres *et al.*, 2013).

In a quest for more consistent answers, some authors have advocated integrating both the agency and resource dependence arguments into a single unified theoretical framework (Kor and Sundaramurthy, 2009; Zona *et al.*, 2018). This theoretical integration has led to a growing number of studies focusing on board (human and social) capital. The concept of board capital was introduced by Hillman and Dalziel (2003) as a proxy for the board's ability to provide resources to the firm and monitor its executives. According to the authors, board member capital includes human capital and social capital. Thus, while the board's human capital is defined by the individual knowledge, skills, expertise, experience and reputation of all its directors (Becker, 1964; Coleman, 1988), its social capital includes current and potential resources embedded within, available through, and derived from all the relationships established by each director (Nahapiet and Ghoshal, 1998; Haynes and Hillman, 2010).

More recently, the development of the resource-based view continued within the framework of dynamic capabilities (Teece *et al.*, 1997; Teece, 2007), and the board's capital became the board's intellectual capital (Berezinets *et al.*, 2016). It is here where our work is framed.

2.1. Board networks under the dynamic capabilities framework

In the dynamic capabilities framework, Berezinets *et al.* (2016: 637) define the intellectual capital of the board of directors as "the ability of the board to extract future economic benefit from the intangible resources possessed by members of the board (their knowledge, experience, skills, networking resources, etc.)". In this sense, board

intellectual capital is not considered a static stock of intangible resources but rather the dynamic ability to derive benefits from it.

As regards boards' connections, although they have always been related to the creation of social capital –since they involve influence, contacts and access to external critical resources-, we feel that they are not always a source of intellectual capital because they will only generate benefits when the resources they provide (contacts, influence, knowledge, skills…) are strategically useful (e.g. when giving information about the context in which the firm operates or when providing access to the focal company industry's specific resources) and when they are established through directors who can use them effectively (e.g. directors who are not over-stretched and can contribute to the decision-making of the firms they advise and monitor).

Following these arguments, we believe there to be no direct (broadly applicable) effect of board networks on firm performance, but rather that this will depend on the context in which they occur (intra-industry *vs.* inter-industries) and on the role of the person establishing them (outsider *vs.* insider). As some previous authors have done (Fernández-Méndez *et al.*, 2015), we keep our options open with regard to board networks and firm performance and we formulate our hypothesis in a null sense:

H1. There is no direct relationship between board networks and firm performance.

Our open options may begin to close when we specify the context in which board interlocks are established and the kind of directors who serve on other firms' boards. Beginning with the context in which board connections are established, we feel it is particularly interesting to differentiate between intra-industry and inter-industry networks. In this sense, many authors highlight the importance of the networks established within the focal company industry because they generate resources which, in

line with dynamic capabilities, are more suitable for transformation into economic benefits for the firm.

Director embeddedness in the firm's primary industry through interlocking directorships, managerial positions, or previous occupational experience in the same industry has been called "board capital depth" (Haynes and Hillman, 2010; Schiehll *et al.*, 2017). This concept, based on cognitive research, includes all of the intra-industry human and social capital, and conjectures that groups with experience and networks concentrated in a related domain, rather than dispersed across different industries, have highly developed knowledge structures for that specific industry (Carpenter and Westphal, 2001; Schiehll *et al.*, 2017).

Intra-industry networks provide directors with access to valuable resources, including industry-specific information, tacit knowledge of the opportunities, potential partners, threats, competitive conditions, technology, and specific regulations about that industry (Spender, 1989; Boeker, 1997; Kor, 2003; Lai *et al.,* 2014; Schiehll *et al.*, 2017). These board connections can help to directors understand the critical elements of the industry environment, pinpoint emerging opportunities in the industry, evaluate managers' proposals for growth (Castanias and Helfat, 2001; Kor and Sundarmurthy, 2009), address environmental uncertainty by gaining superior knowledge of competitors and industry opportunities (Wu, 2008; Wincent *et al.,* 2010; Schiehll *et al.*, 2017), and can help the firm engage in new business relationships that are vital for growth (Pfeffer and Salancik, 1978; Hillman and Dalziel, 2003). Consequently, when board linkages are defined in a given industry (intra-industry networks), connections prove most beneficial for strategic management because the information they transfer is not available elsewhere (Haunschild and Beckman, 1998). For all of these reasons, we understand that intra-industry board connections improve the quality of the decisions taken by the

board and ultimately have a positive effect on firm performance. We therefore hypothesize:

H2. Intra-industry board networks have a positive effect on firm performance.

Additionally, in this study we also posit possible differences that may exist in the previous arguments when we analyse the networks between outsiders or insiders. Despite all the benefits described related to gathering human and social capital by serving on other firms' boards, there are also costs associated (Oh *et al.*, 2006). If directors wish to perform their advisory and governance duties effectively, not only will they need an incentive to do so (Hillman and Dalziel, 2003) but will also have to dedicate their time, energy and attention to carefully studying a firm's unique strategic and governance problems (Carter and Lorsch, 2004). Only if they have the motivation and dedicate the time will they be able to take advantage of their involvement in the boards. In other words, serving in several networks might be considered interesting under a resource dependency approach because it involves accumulating resources. Yet when thinking in broader terms, under a dynamic capabilities approach and when valuing the actual use of these accumulated resources, we realise they cannot be used effectively if there is a lack of incentives or commitment. When directors fail to attend board meetings regularly or fail to prepare for them, their contributions to the board are adversely affected because they do not immerse themselves sufficiently in each firm's activities (Baysinger & Hoskisson, 1990; Conger *et al*., 2001; Kor and Sundaramurthy, 2009).

All of these arguments are usually put forward for board interlocks in general, without taking into account whether these directors maintain an executive relationship with the focal company or not. However, we understand that the lack of time or energy will be more pronounced when networks are established among insiders who, in addition to

belonging to other boards, must devote their time to the executive management of the company. Furthermore, when networks are established between insiders, they will lack any incentive to monitor since they form part of the executive team they must supervise and, therefore, may face a conflict of interest when attempting to perform their duties effectively. Consequently, the difficulties (lack of time, energy, incentives…) involved in holding several board positions are more worrying when the director is, at the same time, an executive of the firm. This is because the potential distraction of multiple directorships is more challenging when directors are also executives of the firm (Ferris *et al.*, 2003) since the lack of time or attention not only disturbs company governance (through their role as director) but also their managerial function (through their role as a company officer or executive) (Liu and Paul 2015).

Therefore, although board networks can provide access to similar resources (human and social capital), regardless of whether they are established between insiders or outsiders, we understand that the associated costs or difficulties are higher in the case of insiders' networks. In contrast, the benefits of accumulating resources through board interlocks would be more easily transferable to economic results when they are carried out through outsiders. In this line, we propose that:

H3. Board networks established among outsiders have a positive effect on firm performance.

Finally, we aim to explore the effect of board connections established in a context that generates information which proves particularly rich for the company (i.e. intra-industry networks) and how these relationships are established through directors who are less affected by lack of time or energy or even conflicts of interest when using the resources obtained (i.e. outsiders). In these cases, we expect the beneficial effect of networks to be even stronger.

H4. Intra-industry board networks established among outsiders have a positive effect on firm performance.

3. Sample, data and methodological issues

Here we present a longitudinal study of the networks formed by the main Spanish listed firms and their directors in the period 1999-2015. Our sample is comprised of all Spanish listed firms and their directors included in the BoardEx database with available economic data in Thompson One. Our final sample thus consists of 102 Spanish firms listed on the IGBM index for the period 1999-2015, and analyses their relationships through a total of 2,310 directors.

A descriptive analysis of the networks we found among the directors in the sample is presented in Table 1. This analysis provides us with information on the changes in the number of firms and directors over the period 1999-2015, the average size of their boards of directors, the average number of directorships held by each director, and the distribution of directors between insiders and outsiders.

As can be seen, the number of firms increased over the period 1999-2015, particularly between 2008 and 2009. As a result, the total number of board seats and directors also increased. However, average board size and the average number of directors per firm decreased each year. This is in line with the idea generally included in the codes of governance of avoiding overlarge boards of directors. It is important to underline the difference between the number of board seats and the number of directors, since the former is the result of adding up all firms' board directorates (board size) during a year, and the latter –the number of directors- is the total amount of different individuals who work as directors. It should be noted that any given director may be a director in more

than one firm at the same time, which is why the average number of directors per firm is always smaller than the average number of board seats by firm (board size). Average directorships represents the occupancy level of a director; that is, how many positions are held by each director. This figure is calculated by dividing the total number of board seats by the number of directors in the sample and, as can be seen in the table, is the basis of our interlocking relation since it shows that, on average, each director sits on more than one board (from 1.15 in 1999 to 1.13 in 2015). These values evidence the fact that Spanish directors hold a low occupancy level on average, although perhaps most of the relationships in the network are sustained by a few directors who are very well-connected.

Table 1 also shows the distribution of directors by year according to their role as insider or outsider. A predominance of outside directors is apparent, with values around 80% throughout the period analysed, a figure which is even seen to increase. This also means they play a leading role in network composition. Again, this situation is supported by the greater importance attached to the role of outsiders in recent years.

[Insert Table 1 here]

3.1. Measuring board networks through the social networks approach and busy boards

As other authors have done (e.g. Kaczmarek *et al.*, 2014), in order to examine the effect of board networks on performance, we decided to use two measures that are conceptually opposed: firm centrality and busy boards.

As regards the firm centrality measurement, when counting the number of board connections, we did not limit the variable, as other previous studies have done, but opted rather to enrich this variable by using the social networks approach. The analysis of network links is applied in order to evaluate links among individuals, links between individuals and organizations, and links among organizations (Lee and Yang, 2014). We focus here on links between individuals, specifically between board directors. The social network approach allows us to draw the connections between the firms through their director interlocking relations (see Figure 1). In this case, each firm is a node and their relationships with other firms are shown by lines that run between them. Each line represents the existence of at least one director with a seat on both boards of directors.

[Insert Figure 1 here]

Some authors (Larcker *et al*. 2013; Li *et al*. 2013) have measured firm centrality by considering each firm as a node (as shown in Figure 1). However, given that our aim is to analyse the relationships between the different types of directors (insiders *vs* outsiders and intra-industry *vs* inter-industries), we follow Ong *et al.* (2003) and Omer *et al*. (2014) by considering each director as a node. This degree measure is built from a director's rather than from a company's perspective. First, we calculate the degree held by each firm director, then normalise the values and adjust them to the size of the board[1]. Finally, we calculate the firm degree measure as an average of this adjusted normalized degree held by each of its board directors.

[1] Note that the relevant relations for the firm are those held with directors from other firms. Therefore, we remove from the measure those relationships held with directors who are part of the same board. Hence, the degree obtained for each director, taking into account the board of directors they belong to, is the adjusted normalized degree.

We used the specific UCINET VI (Borgatti *et al.* 2002) social network analysis software package to establish social networks, to calculate centrality measures, and to prepare the matrices. The centrality measure used as an independent variable is the degree. This is the simplest and most intuitive centrality measure as it states that the greater the degree at any one point (firm or director), the more central it is (Freeman 1979).

In addition, as not only is merely generating relationships but also using them appropriately considered to be important, we also measure the board networks in our analysis through the figure of busy board directors. When studying this figure separately, our aim is to ascertain whether the effect of these directors on firm performance differs from the centrality measure, because we understand that busy directors are the most likely to become overwhelmed or to face conflicts of interest that would prevent them from efficiently applying the resources (knowledge, skills, experience…) they are extracting from the networks. Thus, if their ability to create value may be compromised, the network would neither generate board intellectual capital nor the ability to benefit from the firm's performance.

3.2. Analytical model and variables

Having described the sample and the different measures for the board networks used in the empirical analysis, we introduce the following analytical model to test the previously defined theoretical hypotheses:

$$PERFORMANCE_{i,t} = \beta_0 + \beta_1 \text{ BOARD NETWORKS}_{i,t} + \beta_2 \text{ INDUSTRY CENTRALITY}_{i,t} + \beta_3 \text{FIRM CONTROL VARIABLES}_{i,t} + \beta_4 \text{ BOARD CONTROL}$$

$$\text{VARIABLES}_{i,t} + \beta_5 \text{ INDUSTRY DUMMIES}_{i,t} + \beta_6 \text{ YEAR DUMMIES}_{i,t} + \mu_{i,t} \quad (1)$$

where i represents the firm (from 1 to 102) and t the temporal period (from 1999 to 2015). A brief definition of all the variables included in the model and their main descriptive statistics is included in Table 2.

[Insert Table 2 here]

We use two different variables to measure firm PERFORMANCE in order to obtain more robust results in our analysis: one related to external performance (market to book value -MB-) and the other to internal performance (return on assets -ROA-). We measure the BOARD NETWORKS in the model as firm centrality calculated with UCINET IV software (DIRECTORS CENTRALITY). Although this is our key variable when measuring board networks, we also introduce the concept of busy directors into the empirical contrast of the model. To do so, we calculate the percentage of busy directors in a board (BUSY DIRECTORS). Following previous literature (i.e. Ferris *et al*. 2003; Fich and Shivdasani 2006; Field *et al*. 2013), we define a busy director as one sitting on the board of three or more firms at the same time. INDUSTRY CENTRALITY measures the firm's centrality inside its industry.

All of the previously defined variables were divided into two considering the role the director -insider *vs.* outsider- played in the boards. Following previous literature (e.g. Singh, 2007; Andrés *et al.*, 2017), we considered insiders to be directors that BoardEx recorded as "executive director (ED)" and outsiders to be others recorded as "supervisor director (SD)". We find the following variables in the empirical tests: INSIDERS CENTRALITY vs. OUTSIDERS CENTRALITY; BUSY INSIDERS vs. BUSY

OUTSIDERS; and INDUSTRY INSIDERS CENTRALITY vs. INDUSTRY OUTSIDERS CENTRALITY.

Finally, we included both firm and board control variables in the model. As regards the firm control variable, we use: firm size, measured by the Napierian logarithm (log) of total assets (ASSETS); the ratio of the firm's long-term debt-to-book assets as a measure of the firm's leverage (DEBT); and the number of years since the firm was established as an economic entity (AGE). As regards board control variables, we use: the Napierian logarithm number of directors belonging to the board of directors of a firm (BOARD SIZE); and the proportion of outsiders in the board of directors (BOARD INDEPENDENCE).

3.3. Technical statistics

Following some of the most current papers about board networks (e.g. Zona *et al.*, 2018), we apply to our dataset the panel data analysis as the most efficient tool to test the hypotheses when having a longitudinal sample. The panel structure allows us to consider the unobservable and constant heterogeneity of each firm and to examine the response processes over time (Arellano, 2003). This reduces the problem of omitted-variables (Hsiao, 2003). The STATA Version 10 econometric program allows us to address problems of unobserved heterogeneity and endogeneity among the variables by calculating estimators with specific methodologies such as the Generalized Method of Moments (GMM). The GMM system estimator developed by Arellano and Bover (1995) and Blundell and Bond (1998) is particularly appropriate when we have: a linear functional relationship; a dynamic left-hand side variable, depending on its own past realizations; non-strictly exogenous independent variables; fixed individual effects; and,

heteroskedasticity and autocorrelation within individuals, but not across them (Roodman, 2009).

4. Results

The different model estimations are found in Tables 3 (MB) and 4 (ROA). We controlled for multicollinearity problems by using the variance inflation factor (VIF). As none of the factors exceeds 2, we find no multicollinearity problems in any regression.

[Insert Tables 3 and 4 here]

In order to obtain robust results, we included step by step the variables related to each of the different effects previously described. The first two columns of the tables show the results of the first hypothesis proposed, i.e. the inexistence of any direct effect of board networks (through firm centrality –DIRECTORS CENTRALITY- and busy directors –BUSY DIRECTORS- respectively) on firm performance. As expected, we obtain no significant results for any of the performance measures (MB in Table 3 and ROA in Table 4). Subsequently, in line with Fligstein and Brantley (1992) and Fernández-Méndez *et al*. (2015), we find support for our first hypothesis (H1) as we find no direct relationship (either positive or negative) between any of the variables used to measure board networks and firm performance.

Tables 3 and 4 also show that the only variable that remains significant both when introduced alone (third column of Tables 3 and 4) and in the global model (fourth columns of Tables 3 and 4) is the measurement of directors' intra-industry centrality

(INDUSTRY CENTRALITY). When analysing the effects of a well-connected board inside a given industry, we see a positive and significant effect of the degree on both the firms' market to book ratio (MB) (Table 3) and its return on assets (ROA) (Table 4). We can thus say that our second hypothesis (H2) is confirmed. These results support the benefits of so-called "board capital depth", as we find that networks focussing on the same industry increase corporate performance. In this sense, we understand, as Lai *et al.* (2014) or Schiehll *et al.* (2017) among others point out, that intra-industry connections give directors valuable specific resources that help them to carry out their monitoring and advisory roles more effectively.

After these general models, we divided each of the variables used to measure board networks (DIRECTORS CENTRALITY and BUSY DIRECTORS) into two others (insider *vs.* outsider) to test the last hypotheses of the paper (H3 and H4). As can be seen in Tables 5 (MB) and 6 (ROA), when analysing firms' centrality depending on the role played by the directors in the board (first and second columns in Tables 5 and 6) (INSIDERS CENTRALITY *vs* OUTSIDERS CENTRALITY), we still fail to find any significant effect either from insiders or outsiders. The same happens when studying the different effect of the proportion of busy insiders or outsiders (BUSY INSIDERS *vs* BUSY OUTSIDERS) on firm performance. None of the variables used has any significant impact on firm performance. We therefore reject our third hypothesis (H3) since the board networks established among outsiders have no positive (or negative) effect on firm performance.

However, as occurred with the general model of Tables 3 (MB) and 4 (ROA), we observe a significant influence of intra-industry networks. In fact, when distinguishing between insiders and outsiders, we see that the positive effect stems only from outsiders' connections. This result allows us to support our last hypothesis (H4) given

that the intra-industry board networks established among outsiders have a positive effect on firm performance. As can be seen, although board intra-industry networks provide access to similar specific resources, the ability of the networks to create firm value depends on the kind of director establishing the connection. In line with Liu and Paul (2015), who find that directors' busyness is more pervasive for inside directors (who are important both in the boardroom and in day-to day operations) than for outside ones, we find that firms obtain more benefits when knowledge and experience come to the board through its outside directors. This is because their lack of time (resulting from their multiple directorships) does not affect the firm's managerial activities.

[Insert Tables 5 and 6 here]

5. Discussion and conclusions

We use arguments from the dynamic capability theory to explain whether it is possible to expect a general board interlocking effect on performance or, should this not be the case, what kind of board networks might create more value for companies. Under this theoretical framework, merely accumulating resources (static stock of resources) is no longer sufficient to generate corporate value. These resources actually need to prove valuable to the company and to be used efficiently (dynamic ability) by directors. These arguments are in line with Hillman and Dalziel (2003) who affirm that if directors are to fulfil the role of monitor and advisor efficiently they not only need the ability (which they relate to the accumulation of resources) to execute such roles but also the incentives to use their ability effectively. To analyse the validity of these theoretical arguments, we propose that the most advantageous board networks are those that provide specific strategic resources for the company (intra-industry interlocks) and that

are established through directors who suffer fewer time or energy restrictions (outsiders).

Using a sample of Spanish firms from 1999 to 2015, we find no evidence of direct effects of board networks on performance. This result (or lack of it) confirms that the influence of these networks on firm performance cannot be studied alone but must be framed within a more concrete context if specific effects are to be pinpointed. Accordingly, our data shows that directors' connections only add value to a firm through the specific knowledge derived from the multiple directorships in a single industry -what we call intra-industry networks-. Following Geletkanycz and Boyd (2011), we therefore maintain that the relationship between interlocking and firm performance is contextual and dependent upon the firm's external context, in this case, the specific industry in which the focal company works, since the specific intangible resources derived from intra-industry networks are the only ones that are strategically valuable enough to help directors create firm value.

As regards the role of interlocked directors, contrary to our expectations, we find no evidence to support a different effect resulting from networks between insiders or outsiders. We therefore feel that directors' ability (measured in terms of time and energy) to use network resources has no direct effect on firm performance. For this reason, if the resources provided by the network are not valuable enough (i.e. inter-industries ones), it does not matter whether the network is established among insiders or outsiders, since in no case will it generate value. Nevertheless, when exploring the differences between insiders' and outsiders' networks within a single industry (intra-industry networks), we see that the more beneficial networks are those established by outsiders inside the same industry. Therefore, although the quality of the networks

directly influences firm performance, this effect is only maintained when the network is created by outsiders.

The results we present in this paper may prove useful for practitioners since they can serve as a guide for companies when reformulating their boards in search of the optimal structure. To this end, they must weigh up whether they are interested in incorporating busy directors depending on the sector in which they work, and whether they are willing to establish networks with other firms through their executive directors (taking into account that the possible harmful effects of responsibility and work overload would affect both corporate governance and management).

Our study may also be considered when codes of good governance are updated or renewed. There are already some codes that recommend a different limit for the number of additional board mandates for insiders and outsiders (UK Corporate Governance Code, 2014; French Code de gouvernement d'entreprise des sociétés cotées, 2016). We suggest extending this type of recommendation to other countries, such as Spain, whose Good Governance Code of Listed Companies (2015) does not include such specifications. It would also be interesting to indicate in these codes the need to evaluate differently the setting up of intra-industry or inter-industry networks.

Despite its strengths, this research also evidences certain limitations. First, our study is based on data from a single country. Using only Spanish companies restricts our ability to generalise the results of the study. This limitation gives rise to a future line of research which might explore whether our results could differ depending on country and legal context (e.g. Anglo-American countries vs. continental European ones). Extending this type of work on board networks to an international context might also prove enriching if elements related to the culture of the different countries were embraced. The cultural context in which the links between directors are developed may shape the

effect of these networks on corporate performance. Second, we identify only two types of board members: insiders and outsiders. However, depending on their connection to the firm, outsiders may be divided into affiliates –those with an existing or potential relationship with the firm (e.g. lawyers, financiers…) - and independents -those lacking any kind of link, either to the company or to its owners-. Though both are considered outsiders, these two types of directors might perform their role as advisors and monitors differently because affiliates might build strong ties with top management whereas independents would not (Anderson and Reeb, 2004; Samara and Berbegal-Mirabent, 2018). Future inquiry might incorporate this difference in order to gain an insight into whether there are any differences between the influence of independents' and affiliates' networks on firm performance. Were the positive effect of intra-industry board networks only to hold for independents, we would have evidence to suggest that only when directors have enough incentives will they use the information from networks to fulfil their (monitoring) role effectively.

Finally, in line with previous literature on board networks, we contend that board interlocks are valuable because they build social capital (relationships and contacts). However, many scholars have recognized the existence of interdependence between human and social capital (Coleman, 1988; Nahapiet and Ghoshal, 1998; Haynes and Hillman, 2010). While some authors support the notion that members' knowledge, skills and expertise (human capital) can also give the firm access to other resources through the connections (social capital) they provide (Mizruchi and Stearns, 1994), other authors show that board links (social capital) also lead to exposure to novel information (human capital) (Geletkanycz and Hambrick, 1997; Kor and Sundaramurthy, 2009; Felicio *et al.,* 2014). Consequently, we consider that an interesting future line of research would be to explore how these board networks help the firm to generate new human capital

(e.g. knowledge, experience…) in line with the concept of "learning organization" introduced by Senge (1990).

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Figure 1. Graph of the Spanish firms network in 2015.

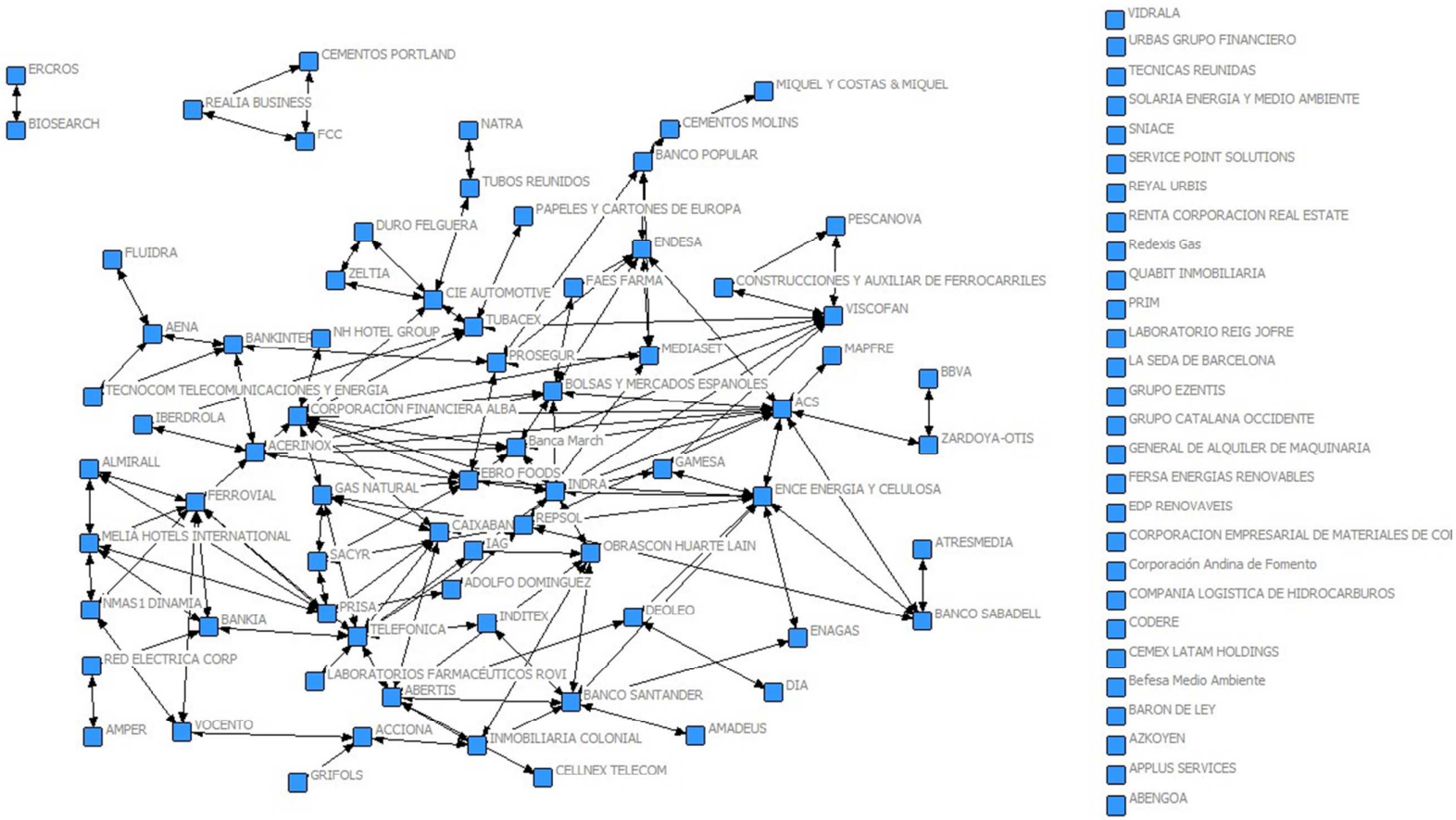

Table 1. Annual Summary Statistics of Sample Characteristics.

YEAR	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Number of firms	33	38	42	45	48	49	55	62	65	58	86	93	103	99	100	95	99
Number of board seats	466	563	610	635	712	683	752	844	847	767	1057	1113	1201	1152	1117	1052	1074
Average board size	14.12	14.82	14.52	14.11	14.83	13.94	13.67	13.61	13.03	13.22	12.29	11.97	11.66	11.64	11.17	11.07	10.85
Number of insiders	95	111	118	134	136	128	141	161	163	136	193	188	209	199	204	193	179
Average percentage of insiders	20.39	19.72	19.34	21.10	19.10	18.74	18.75	19.08	19.24	17.73	18.26	16.89	17.40	17.27	18.26	18.35	16.67
Number of outsiders	371	452	492	501	576	555	611	683	684	631	864	925	992	953	913	859	895
Average percentage of outsiders	79.61	80.28	80.66	78.90	80.90	81.26	81.25	80.92	80.76	82.27	81.74	83.11	82.60	82.73	81.74	81.65	83.33
Number of directors	406	472	510	534	577	553	625	705	700	650	895	956	1038	1000	974	929	949
Average number of directors by firm	12.30	12.42	12.14	11.87	12.02	11.29	11.36	11.37	10.77	11.21	10.41	10.28	10.08	10.10	9.74	9.78	9.59
Average directorships	1.15	1.19	1.20	1.19	1.23	1.24	1.20	1.20	1.21	1.18	1.18	1.16	1.16	1.15	1.15	1.13	1.13

Table 2. Variables and statistics.

	VARIABLE	DESCRIPTION	N. obs.	Mean	Std.Dev.	Min.	Max.
DEPENDENT VARIABLE	MB	Market-to-book ratio	474	3.460	4.224	-0.235	45.279
	ROA	Return on assets	474	0.141	0.175	-0.162	1.289
CENTRALITY VARIABLES	DIRECTORS CENTRALITY	Normalized centrality degree held by firm directors (adjusted to board size)	474	1.001	0.760	0.000	4.511
	INSIDERS CENTRALITY	Normalized centrality degree held by firm inside directors (adjusted to board size)	474	0.884	1.237	0.000	6.565
	OUTSIDERS CENTRALITY	Normalized centrality degree held by firm outside directors (adjusted to board size)	474	1.018	0.818	0.000	5.464
BUSYNESS VARIABLES	BUSY DIRECTORS	Percentage of busy directors (serve on three or more boards simultaneously)	474	0.093	0.102	0.000	0.500
	BUSY INSIDERS	Percentage of busy insiders	474	0.078	0.192	0.000	1.000
	BUSY OUTSIDERS	Percentage of busy outsiders	474	0.094	0.108	0.000	0.600
QUALITY VARIABLES	INDUSTRY CENTRALITY	Normalized centrality degree held by firm directors of the same industry (adjusted to board size)	474	0.015	0.024	0.000	0.226
	INDUSTRY INSIDERS CENTRALITY	Normalized centrality degree held by firm insiders of the same industry (adjusted to board size)	474	0.020	0.050	0.000	0.471
	INDUSTRY OUTSIDERS	Normalized centrality degree held by firm outsidersof the same	474	0.015	0.024	0.000	0.237

	CENTRALITY	industry (adjusted to board size)					
CONTROL VARIABLES - FIRM	ASSETS (in logarithm)	Napierian logarithm (log) of total assets	474	8.669	1.801	2.869	13.850
	DEBT	Ratio of the firm´s long-term debt-to-book assets	474	0.678	0.209	0.046	1.804
	AGE	Number of years since the firm was established as an economic entity	474	3.859	0.846	0.000	5.017
CONTROL VARIABLES - BOARD	BOARD SIZE (in logarithm)	Napierian logarithm of the total number of directors in the board	474	2.585	0.331	1.386	3.526
	BOARD INDEPENDENCE	Proportion of non-executive directors in the board of directors	474	0.801	0.111	0.421	1.000

Table 3. Model estimation for market to book (MB).

Dependent variable: MB	BOARD NETWORKS		INDUSTRY CENTRALITY	GLOBAL MODEL
DIRECTORS CENTRALITY	-0.355 (0.555)			-0.177 (1.384)
BUSY DIRECTORS		-4.291 (3.556)		-8.558 (9.408)
INDUSTRY CENTRALITY			91.017 * (49.617)	95.230 * (49.411)
ASSETS	-0.678 ** (0.324)	-1.003 *** (0.354)	-1.274 *** (0.332)	-1.374 *** (0.414)
DEBT	2.697 (4.193)	0.601 (7.390)	2.954 (5.758)	-0.822 (7.497)
AGE	0.572 (0.982)	0.293 (2.020)	1.579 ** (0.794)	2.347 * (1.229)
BOARD SIZE	0.272 (1.225)	-1.196 (1.254)	-2.041 (2.933)	-2.962 (2.174)
BOARD INDEPENDENCE	7.131 (7.932)	-2.840 (7.735)	1.486 (3.368)	3.421 (4.254)
MB (t-1)	0.668 *** (0.239)	0.638 *** (0.193)	0.732 *** (0.143)	0.727 *** (0.140)
Constant	-3.512 (8.142)	10.011 (9.771)	7.875 (6.123)	8.618 (6.384)
Industry dummies	Yes	Yes	Yes	Yes
Year dummies	Yes	Yes	Yes	Yes
No. observations	409	409	409	409
Wald Test	301.08 ***	127.77 ***	213.27 ***	230.73 ***
d.f.	(18)	(18)	(18)	(20)
AR(1)	-1.70 *	-1.84 *	-2.39 **	-2.35 ***
AR(2)	1.33	1.55	1.25	1.16

Hansen test d.f.	33.92 (30)	39.22 (30)	27.59 (30)	30.39 (30)
VIF	1.28	1.29	1.36	1.89

Note: ***, ** and * indicate significance at the 99%, 95% and 90% confidence level, respectively.

Table 4. Model estimation for return on assets (ROA).

Dependent variable: ROA	BOARD NETWORKS		INDUSTRY CENTRALITY	GLOBAL MODEL
DIRECTORS CENTRALITY	-0.019 (0.021)			-0.044 (0.039)
BUSY DIRECTORS		-0.190 (0.141)		-0.075 (0.219)
INDUSTRY CENTRALITY			1.384 ** (0.653)	1.572 * (0.888)
ASSETS	-0.027 * (0.015)	-0.025 * (0.015)	-0.006 (0.015)	-0.025 * (0.014)
DEBT	0.091 (0.108)	0.058 (0.111)	0.009 (0.200)	-0.003 (0.170)
AGE	0.015 (0.013)	0.019 (0.012)	0.056 (0.075)	0.016 (0.020)
BOARD SIZE	0.037 (0.027)	0.038 (0.025)	0.044 (0.085)	-0.041 (0.084)
BOARD INDEPENDENCE	0.013 (0.060)	0.028 (0.067)	-0.001 (0.139)	0.053 (0.110)
ROA (t-1)	0.938 *** (0.071)	0.938 *** (0.055)	0.737 *** (0.112)	0.656 *** (0.120)
Constant	0.090 (0.101)	0.067 (0.108)	-0.279 (0.460)	0.285 (0.156)
Industry dummies	Yes	Yes	Yes	Yes
Year dummies	Yes	Yes	Yes	Yes
No. observations	409	409	409	409
Wald Test	985.40 ***	1038.76 ***	98.33 ***	256.65 ***
d.f.	(18)	(18)	(18)	(20)
AR(1)	-3.20 ***	-3.24 ***	-3.18 ***	-3.04 ***
AR(2)	0.87	0.83	0.94	0.60

Hansen test d.f.	28.91 (30)	29.88 (30)	33.01 (30)	31.45 (30)
VIF	1.33	1.33	1.37	1.91

Note: ***, ** and * indicate significance at the 99%, 95% and 90% confidence level, respectively.

Table 5. Model estimation for market to book (MB) when we split the networks into executive and non-executives.

Dependent variable: MB	BOARD NETWORKS		INDUSTRY CENTRALITY	GLOBAL MODEL
INSIDERS CENTRALITY	0.361			1.478
	(0.553)			(1.481)
OUTSIDERS CENTRALITY	-0.508			-3.933
	(0.847)			(2.615)
BUSY INSIDERS		-2.982		-6.258
		(2.817)		(4.332)
BUSY OUTSIDERS		-3.984		15.267
		(5.051)		(16.062)
INDUSTRY INSIDERS CENTRALITY			1.205	-7.386
			(6.230)	(18.724)
INDUSTRY OUTSIDERS CENTRALITY			72.939 *	59.432 *
			(42.637)	(34.710)
ASSETS	-1.138 ***	-1.1023 ***	-1.581	-0.576
	(0.419)	(0.368)	(1.021)	(0.691)
DEBT	0.544	2.447	-6.372	-1.771
	(5.525)	(5.305)	(8.700)	(5.914)
AGE	3.650 *	2.992	0.231	0.160
	(2.123)	(2.327)	(2.793)	(2.250)
BOARD SIZE	2.138	1.287	2.167	-1.275
	(1.391)	(1.488)	(2.992)	(2.109)
BOARD INDEPENDENCE	2.404	2.723	-11.682	9.259
	(3.344)	(4.002)	(17.928)	(9.811)
MTB (t-1)	0.714 ***	0.788 ***	0.962 ***	0.967 ***
	(0.183)	(0.234)	(0.168)	(0.093)
Constant	-11.749	-9.148	7.956	-5.657

	(13.523)		(11.837)		(19.981)		(16.890)	
Industry dummies	Yes		Yes		Yes		Yes	
Year dummies	Yes		Yes		Yes		Yes	
No. observations	409		409		409		409	
Wald	154.03	***	128.43	***	478.49	***	2256.38	***
d.f.	(19)		(19)		(19)		(24)	
AR(1)	-1.97	**	-1.96	**	-2.42	**	-2.18	**
AR(2)	1.21		1.59		0.52		0.64	
Hansen test	38.96		39.85		32.52		32.37	
d.f.	(30)		(30)		(30)		(33)	
VIF	1.27		1.26		1.43		1.94	

Note: ***, ** and * indicate significance at the 99%, 95% and 90% confidence level, respectively.

Table 6. Model estimation for return on assets (ROA) when we split the networks into executives and non-executives.

Dependent variable: ROA	BOARD NETWORKS		INDUSTRY CENTRALITY	GLOBAL MODEL
INSIDERS CENTRALITY	0.015			0.012
	(0.015)			(0.031)
OUTSIDERS CENTRALITY	-0.023			-0.059
	(0.020)			(0.038)
BUSY INSIDERS		0.076		-0.100
		(0.141)		(0.164)
BUSY OUTSIDERS		-0.134		0.203
		(0.116)		(0.312)
INDUSTRY INSIDERS CENTRALITY			0.033	-0.109
			(0.156)	(0.616)
INDUSTRY OUTSIDERS CENTRALITY			0.547 *	1.026 *
			(0.314)	(0.598)
ASSETS	-0.022 ***	-0.021 *	-0.046 ***	-0.022
	(0.008)	(0.011)	(0.015)	(0.025)
DEBT	0.067	0.052	0.032	-0.019
	(0.114)	(0.108)	(0.110)	(0.198)
AGE	0.005	0.005	0.028	-0.007
	(0.013)	(0.015)	(0.018)	(0.054)
BOARD SIZE	0.040	0.033	0.099 **	0.036
	(0.028)	(0.040)	(0.039)	(0.040)
BOARD INDEPENDENCE	0.033	-0.068	-0.203	-0.003
	(0.070)	(0.196)	(0.178)	(0.204)
ROA (t-1)	0.968 ***	0.960 ***	0.898 ***	0.740 ***
	(0.078)	(0.098)	(0.066)	(0.149)

Constant	0.045 (0.082)	0.152 (0.201)	0.252 (0.194)	0.072 (0.360)
Industry dummies	Yes	Yes	Yes	Yes
Year dummies	Yes	Yes	Yes	Yes
No. observations	409	409	409	409
Wald	1053.06 ***	985.16 ***	1331.73 ***	633.37 ***
d.f.	(19)	(19)	(19)	(24)
AR(1)	-3.23 ***	-3.09 ***	-3.12 ***	-2.87 ***
AR(2)	0.84	0.79	1.08	0.58
Hansen test	27.34	28.29	27.05	37.01
d.f.	(30)	(30)	(30)	(33)
VIF	1.31	1.30	1.44	1.99

Note: ***, ** and * indicate significance at the 99%, 95% and 90% confidence level, respectively.