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DETERMINANTS OF THE STRUCTURE OF BOARDS OF DIRECTORS: THE CASE OF SPAIN

Abstract:

This study focuses on an analysis of the board of directors as an element for solving governance and control problems. It analyses the determinants of the size and composition of the boards of directors using a sample of Spanish firms trading on the stock exchange in the 2004-2007 period. The results confirm that firms choose through a rational choice process, the size and composition of their boards after considering their advisory and control needs. From this endogenous perspective, the research shows that when a greater advisory function is required, firms change both their board size (which grows) and its composition (with a larger proportion of independents). When more monitoring is needed, they tend to alter, predominantly, the board's composition, including more independents.

Key words:

Size of the board of directors, Composition of the board of directors, Corporate governance, Endogeneity, Spain

1. INTRODUCTION

According to Agency Theory, boards of directors play a decisive role, using their advisory and monitoring functions to solve the governance and control problems arising in major corporations.

Traditionally, the literature has considered that a greater presence of independents on boards of directors enables them to more effectively perform their monitoring function, which should have a positive impact on performance. Authors such as Rosenstein and Wyatt (1990), Hermalin and Weisbach (1991), Brickley et al. (1994), Bhagat and Black (2002), etc., have focused on analysing the relationship between board composition and business performance. Others suggest that board effectiveness varies with the number of members, analysing the relationship between board size and performance (Yermarck, 1996, Conyon and Peck, 1998, Eisenberg, et al. 1998, Mak and Kusnadi, 2005, McIntyre et al. 2007, Bennedsen et al. 2008, Cheng, 2008, etc.).

Most of these studies, and some of the recommendations made by so-called Codes of Good Governance, conclude that optimal boards are small and have a large proportion of outsiders. However, authors such as Bhagat and Black (2002) insist on the need for insider members in governing bodies, as they can provide values not transmitted by other members. Likewise, another question already rose by Hermalin and Weisbach (2003) would be: if there is an optimal structure for all boards, which do firms with differently configured boards survive?

In response to that question, a new field of research arose based on the endogeneity approach, seen in Hermalin and Weisbach (1988, 1998), Bathala and Rao (1995) and Lehn et al. (2004), among others, considering that board size and composition are endogenously determined in each organised based on both internal and external factors. Moreover, according to Coles et al. (2008), if each firm chooses a board structure based on a need to maximise profits and there are no transaction costs preventing such a structure from being used, no relationship should be found between board configuration and performance.

The objective of this study is to analyse the internal and external factors that influence the size and composition of boards of directors in Spain. Assuming that each firm has different advisory and monitoring requirements, and that board structure depends on such requirements, two hypotheses, a complexity hypothesis and a monitoring hypothesis, are tested. These hypotheses were tested on a sample of 171 Spanish firms trading on the Stock Exchange during the 2004-2007 period, with robust results which, in line with Boone et al. (2007), Coles et al. (2008) and Linck et al. (2008) among others, show that board composition (measured by the percentage of independents members) and size (measured by the number of board members) are established by a rational choice process which considers each firm's specific characteristics and needs.

The paper makes the following contributions. In the Spanish literature, no studies have been found in the field which analyse board size and composition determinants from an endogeneity perspective.

Some studies (Mínguez and Martín, 2003; Fernández et al., 1998) have focused on analysing the relationship between board composition and corporate value, attempting to identify generally applicable rules regarding board composition. Others (Gispert, 1998) analyse the effects of factors such as performance on board rotation and the relationships between ownership structure and board structure (Gutiérrez et al., 2000) but do not fully analyse board composition determinants. Regarding international literature, it is important to highlight that this study is conducted in a context that differs from the Anglo-Saxon context broadly analysed. In Spain, firms are characterised by highly concentrated ownership, and the market for corporate control is weak, so board size and composition determinants could have a different impact than that observed in the British and North American context. According to Li (1994), corporate governance differs considerably among countries, given their peculiar characteristics related to ownership structure, regulation, etc. It could therefore be interesting to analyse a different setting. As Shleifer and Vishny (1997) mention, most of the empirical studies on corporate governance focus on the North American market, and there is little evidence from other countries. Likewise, as Guest (2008) indicates "*examination of other countries is therefore useful in developing a broader view of what determines board structure*". This paper, based on agency theory and using a recent theoretical approach, endogeneity, thus fills a gap in the Spanish and international literature.

The paper is structured as follows. Section 2 provides a review of the literature and presents the hypotheses to be tested. We then describe our sample and the variables used in the study, continuing in Section 4 to discuss the methodology and principal results obtained. Finally, our conclusions consider the results and propose future lines of research.

2. DETERMINANTS OF THE SIZE AND COMPOSITION OF BOARDS OF DIRECTORS

2.1. The functions of the board of directors

Although the functions of a board of directors can be broken down into a number of specific tasks which differ for different authors[2], there is considerable consensus in the literature in that board activities focus on two central functions:

- Guide or provide advice regarding the firm's management and strategy → *advisory function*
- Supervise and control → *monitoring function*

[2] See Gutiérrez et al. (2000) or the classification proposed by the American Business Roundtable Association (http://www.businessroundtable.org/).

Advisory function

Directors act as "advisors" in the organisation, as thanks to the information they have about the firm or its environment, their expertise, know-how, etc. enrich the firm's decision-making process. The literature shows that large boards more efficiently perform the advisory function with more independent members, because the more members there are, the greater the variety of opinions and perspectives. According to Boone et al. (2007), as information requirements increase, larger boards are needed.

The role of independents (outsiders in the Anglo-Saxon context) is also crucial in the advisory function. These board members are usually highly experienced and renowned professionals in their fields. According to Coles et al. (2008), it is the outsiders who advise the CEO (Chief Executive Officer) in the choice of the organisation's business strategy.

All this shows that efficiency in the advisory function increases with the size of the board and with the presence of independents.

Monitoring function

The second function of boards of directors refers to control and supervision. The board should act as a control mechanism, supervising corporate management in order to reduce conflicts of interest and the agency problem between managers and investors, when ownership and control are separate. Unlike the situation found in the US, however, where the main problem consists of preventing opportunistic managerial behaviour, in European countries divergence of interests is often generated between large and small shareholders, as a result of the high level of ownership concentration found in firms in continental Europe (Baglioni and Colombo, 2009). In this context, then, the board of directors also has to ensure that such divergence of interests does not undermine those of small investors.

As Boone et al. (2007) suggest, a board's supervision can be expected to be less effective in the case of large boards, as they are more likely to suffer from free-riding problems among their members and coordination difficulties which would all prevent an effective monitoring function. On the other hand, the independents[3] on a board help to minimise agency problems between managers and shareholders (Bathala and Rao, 1995) or between major and small shareholders (Baglioni and Colombo, 2009), as these types of board members, who have no direct links to the organisation, are unlikely to be affected by problems such as a tendency to toe the group line or subordination to the CEO's decisions which are more likely among insider members. As suggested by Coles et al. (2008), outsiders act as executive management supervisors.

[3] Note that, in this study, the composition of a board of directors is measured by the percentage of independent members, instead of the percentage of outsiders used by other authors in the international literature. The reason for this choice is explained in section 3.2.

Small boards, therefore, with a large proportion of independents, can be expected to perform the monitoring function more effectively.

2.2. Hypotheses

Complexity hypothesis

In relation to the advisory function of boards of directors, the literature shows that the firm's complexity is a central and decisive aspect, as the need for advice generally increases as a firm becomes more complex. In this respect, the greater a firm's complexity, the greater the need for the board to advise the CEO well, and this requires a large board of directors with a significant number of independents. As suggested by Boone et al. (2007), as a firm grows (becomes more complex), it needs more specialised services from its board, particularly in relation to its advisory function.

H1: More complex firms have larger boards with more independent members

Different variables have been used as proxies in order to analyse the complexity of organisations: size of the firm, opportunities for growth, degree of diversification and firm age.

With regards to firm size, several authors (Lehn et al. 2004; Boone et al. 2007; Coles et al. 2008; etc.) suggest that larger firms can be expected to have larger boards with more independent members, as a diversity of activities on a larger number of markets involves more complexity and, therefore, a greater need for information. With regards to opportunities for growth, Yang et al. (2004) argue that growing firms have more business opportunities by definition, and therefore need to make important strategic decisions. On the one hand, this requires more board members to perform a better advisory function and, on the other, the experience of independent board members would be useful when evaluating new investment projects. In the literature, diversification has also been used as a proxy for complexity. More diversified firms operating in multiple market segments tend to be more complex and to therefore have larger boards with independent members (Coles et al. 2008). As suggested by Pearce and Zahra (1992), diversification could require skills not found among company members, thus needing outsiders to provide better advise and guide the decision-making process. Finally, some studies use firm age as a key factor in the complexity of firms, based on the idea that the most complex organisations are the oldest (Boone et al. 2007), thus expecting a positive relationship between a firm's age, the size of its board and the proportion of outsiders.

Control hypothesis

The second primary function of a board of directors is a monitoring function. The need for a board to correctly act as a monitoring body increases when there are no other control mechanisms. If such mechanisms are weak or completely absent, the board's monitoring function becomes even more important; this requires a smaller board with a large proportion of independents to guarantee effective monitoring.

H2: As the need for control grows (weak or no other control mechanisms), boards become smaller with a larger proportion of independent members

In the literature, managerial ownership, ownership concentration, level of debt and leadership structure have all been used as proxies for control mechanisms other than the board of directors.

Different authors have proposed ownership structure as a control mechanism. In this respect, according to Jensen and Meckling (1976), increasing managerial ownership tends to align managers' interest with those of shareholders, which could lead to less conflicts of interest. Likewise, Li (1994) shows that, if ownership is concentrated, the members of a corporation with the most capital can more effectively influence and control its management than when a firm is owned by a larger number of smaller shareholders. A firm's indebtedness can also act as a control mechanism. A certain level of debt generates a series of contractual obligations which reduce managers' discretionary powers regarding the firm's free cash flow, thus guaranteeing better use of resources in optimal activities (Jensen 1986) and a better alignment of shareholder and managerial interests. On the other hand, the need for supervision and control can also vary with the board of directors' leadership structure, depending on whether the Chairman and CEO are one and the same person or different individuals.[4] As shown by Fama and Jensen (1983 a), when the CEO and the Chairman are the same person, this has a negative impact on the board's ability to correctly perform its monitoring function. In these situations, therefore, smaller boards with a larger proportion of independents may be preferable in order to perform this function correctly.[5] Along these lines, Rediker and Seth (1995) suggest that firms in which the Chairman and CEO are the same person require boards with more control power.

The above arguments suggest that less insider participation in the corporation's capital, a not very concentrated ownership structure, a low level of indebtedness and the same person being CEO and Chairman are conditions which require greater board supervision, leading to smaller boards with a larger proportion of independents.

Table 1 shows the expected relationship for each of the proxies of our two hypotheses.

(Insert Table 1)

[4] For a review of the factors influencing the choice of a dual leadership structure or not, and a discussion of the positive and negative aspects, see Finkelstein and D'Aveni (1994) and Faleye (2007). Both these studies discuss the pros and cons of combining the figures of Chairman and CEO.

[5] There are also arguments supporting this hypothesis from an entrenchment theory perspective. According to this theory, managers aim to obtain maximum control in the organisation by eliminating external control whenever possible. They thus prefer small boards dominated by insiders which they also chair. This means that, when the Chairman and the CEO are the same person, smaller boards are preferred because they are easier to control. When this is not the case, larger boards are preferred, as manipulation is easier due to coordination problems, free riders, etc.

3. DESCRIPTION OF THE SAMPLE AND THE VARIABLES

This study considers a sample of Spanish firms in order to analyse the determinants with the greatest impact on the structure of Spanish boards of directors. This section starts by describing the procedure used to select the sample, and the most significant characteristics of the analysed firms. It also details and describes the variables used in the empirical analysis.

3.1. Sample selection and general characteristics

The sample was selected from a set of firms included in the Corporate Governance Reports of organisations issuing stock trading on official secondary markets, edited by the CNMV (National Stock Market Commission) for 2004-2007[6]. After excluding banks, the final sample comprises 171 firms comprising an unbalanced panel for the 4 years in question. The information contained in these reports in relation to shareholder and board structure was completed with the economic and financial information provided by the SABI database.

With regards to the composition of the sample by type of industry, table 2 shows the number of firms in each sector. Based on CNAE 93 Rev.1 codes and the industrial sector classification proposed by the CNMV, we finally obtained eight sectoral segments. We can see that a large number of the firms belong to the property activities and business services sector, which represents more than 34% of the total, followed by the manufacturing industry, which also represents nearly a third of the sample (28.66%).

(Insert Table 2)

3.2. Definition of variables and descriptive statistics

Dependent variables

In order to analyse the determinants of the structure of the boards of directors of Spanish firms, the dependent variables used were the size and composition of said boards. The representative measure of board size used was the logarithm of the total number of board members, whereas the variable representing board composition was the percentage of independent members, both with reference to 2004, 2005, 2006 and 2007. Although other authors in the international literature most commonly use the percentage of outsiders, we have chosen de percentage of independents because the figure of non-executive board members in Spain is not comparable to the outsiders in other contexts, as the role of directors representing substantial shareholders is also of considerable significance. The analysis therefore considers independent members as, according to García and Gil de Albornoz (2005), independent members are equivalent to non-executive members in the UK and US. These variables were constructed from the information provided by the CNMV in its Corporate Governance Reports on organisations issuing stock traded on official secondary markets.

[6] 2004 is the first year for which Corporate Governance Reports were published with a homogeneous format, which is why it was selected as the starting point for our analysis. The period ends with the 2007 financial year, because the 2008 reports had not yet been published at the time of our study.

Independent variables

The databases used to obtain the independent variables were SABI (*Sistema de Análisis de Balances Ibéricos*) for accounting and financial data and the CNMV reports containing information about firms' governance and ownership structure.

Below is a description of the explanatory and control variables used in the study[7]:

- Size of the firm: the logarithm of the average volume of assets on the date of reference and in the two previous financial years (FSIZE).
- Opportunities for growth: in this case, we used Tobin's Q, calculated as the quotient between the sum of market value and assets minus equity over the total assets. In this case, the variable used was the average Q for each 3-year period (Q).
- Diversification: number of business segments in which the firm operates. We used a dummy variable, which has a value of 1 when the firm operates in more than one segment and a value of zero otherwise. The classification used for the definition of the sectors was provided by CNAE 93 Rev.1 on a two-digit level (DIV).
- Age of the firm: number of years since the firm was established as of 31 December on each of the analysed years (FAGE).
- Managerial ownership: the percentage of capital owned by executive board members for each year. We calculated the percentage represented by the number of direct and indirect shares held by each executive board member (INS).
- Concentration of capital: the percentage of capital held by the principal shareholder in each year, considering both direct and indirect shares (CONC).
- Level of indebtedness: the variable used was the total debt ratio divided by total volume of assets. We also calculated the average for the last three years (DEBT).
- Separation between Chairman and CEO: a dummy variable with a value of 1 when the positions are held by two different people and zero when they are one and the same person (SEP).
- Control variables: dummies to identify the different industrial sectors in the sample[8].

(Insert Table 3)

Table 3 shows board structure of the Spanish firms analysed. The mean board size is made up of 9.86 members, similar to data from Coles et al. (2008) for the North American market (10.4 members) or the data showed by Mínguez y Martín (2003) and García y Gil de Albornoz (2005) for the Spanish market (9.88 y 11 board members on average).

[7] The first four variables refer to the complexity hypothesis related to the advisory function of boards. The next four are included as proxies of the control hypothesis.
[8] Table 2 shows the sectoral distribution of the firms in the sample.

With regard to board composition, mean percentage of affiliated members (43.7%) is considerably higher to other categories. This great presence of affiliated members is in keeping with the high level of ownership concentration in Spanish firms. Likewise, the presence of independent members (29.07%) is greater than insiders (23.01%).

Regarding the leadership structure, table 4 shows that 50.16% of the firms present the roles of Chairman and CEO separated. This percentage indicates that there isn't a clear trend between Spanish firms, because half the sample choose an opposite leadership structure. This contrasts with other research carried out in the North-American context, where the percentage of firms whose CEO is also the Chairman is higher. For example, in Yang et al. (2004), Boone et al. (2007), Linck et al. (2007) or Wintoki et al. (2008) among others, the CEO is also the Chairman in the 60% of the cases, and in Faleye (2007) the CEO and the Chairman are the same person in 78% of the companies analysed.

On the other hand, tables 4 and 5 present descriptive statistics for explanatory variables and the correlation matrix respectively.

(Insert Table 4)

(Insert Table 5)

4. METHODOLOGY AND RESULTS

4.1. Methodology

To test our two hypotheses, we defined two regressions for each of the two dependent variables. The proxies of the study hypotheses are included as explanatory variables. We also included a set of dummies related to industrial sectors as control variables[9]. On the other hand, we included the size of firms squared ($FSIZE^2$) in order to explore whether the relationship between size of firm and board of directors configuration is linear or not, as was also contemplated by Lehn et al. (2004).

The model is shown in the following regressions:

(1)

$$BoardSize = \alpha + \beta_1 FSIZE + \beta_2 Q + \beta_3 DIV + \beta_4 FAGE + + \beta_5 INS + \beta_6 CONC + \beta_7 DEBT + \beta_8 SEP + \beta_9 FSIZE^2 + \sum_{i=1}^{7} \delta_i DummyInd + \sum_{i=1}^{3} \gamma_i DummyYear$$

(2)

$$Independents = \alpha + \beta_1 FSIZE + \beta_2 Q + \beta_3 DIV + \beta_4 FAGE + \beta_5 INS + \beta_6 CONC + \beta_7 DEBT + \beta_8 SEP + \beta_9 FSIZE^2 + \sum_{i=1}^{7} \delta_i DummyInd + \sum_{i=1}^{3} \gamma_i DummyYear$$

[9] A series of variables were also included to reflect time-related effects, as the tests showed that these dummies are significant and therefore form part of the model.

These regressions were estimated using panel data methodology, finally selecting a Fixed Effects model[10]. The inclusion of fixed effects also solves the problem of missing variables that might not be correctly processes through random effects (Greene, 1999). The necessary tests were also performed to detect possible model specification problems for each of the two dependent variables. First, we applied the Wooldridge test to detect possible autocorrelation of the models, and it was confirmed. The Modified Wald Heteroscedasticity test also confirms the existence of this problem in the models. In order to solve all these problems, we decided to use Feasible Generalized Least Squares – FGLS – estimators, which considerably improve the models' results.

4.2. Results

This section discusses the principal results obtained when estimating the two regressions using the Feasible Generalized Least Squares method. We decided to include each of the explanatory variables separately, in order to analyse their direct impact on the size and composition of boards, and separately determining the variables' predictive power (Li, 1994). We then included all the variables related to each of the two hypotheses.

Determinants of board size

(Insert Table 6)

Table 6 shows the impact of the factors related to the complexity hypothesis on the size of boards of directors. We see that the organisation's size is a relevant variable when analysed both jointly and separately, as in both cases the coefficient is positive and significant, showing that the larger the firm, the larger the board. This is consistent with the evidence found by Boyd (1990), Denis and Sarin (1999), Lehn et al. (2004), Boone et al. (2007) and Coles el al. (2008), among others, who obtain a positive and significant relationship between firm size and board size.

We also see that the relationship between firm size and board size appears to be non-linear, as models 1 and 5 show that the coefficient of the variable representing the quadratic effect of the firm size is both negative and significant. Therefore, the larger the firm, the larger the board, but only up to a certain point at which the number of directors ceases to increase or increase but at a decreasing rate. What this relationship actually shows is that there is a maximum point in the board size function, meaning that when a firm has grown to a certain size, it ceases to add new members to its board. As suggested by Baglioni and Colombo (2009), the negative coefficient of the quadratic term could show that as a firm grows, so does its board, but at a falling rate.

[10] The models considered were initially a pooled OLS model, a fixed effects model and a third model with random effects. To distinguish the convenience of each model, they were compared and tested and the fixed effects model was finally selected after application of the Hausman test. Although the Hausman test initially showed that it was also possible to use a random effects model, after solving the heteroscedasticity and model autocorrelation problems, the same test showed a preference for fixed effects. The results of these tests are available upon request.

(Insert Figure 1)

Graph 1, obtained by representing the equation estimated in Model 11 (Table 7) when all the explanatory variables except firm size are at their mean value, reveals how the size of the board shows a growing trend as the firm grows (positive relationship) but, at a certain level (firms with 2,791,933 million euros[11]), the number of board members stabilises (negative relationship), also consistent with the evidence found by Lehn et al. (2004). According to these authors, with more than a certain number of board members, the coordination costs and associated free rider problems could be too large, thus explaining the non-linear relationship. This has to be taken with caution, however, as in both his study and ours, there are few observations with a firm size larger than this maximum point, and this also affects the non-linear relationship obtained.

We can also see the expected positive and significant relationship between opportunities for growth (Q) and board size, as obtained in Yang et al. (2004). These results mean that as a firm's size or opportunities for growth increase, it becomes more complex and therefore needs a larger board of directors. Also, both a firm's degree of diversification and its age appear to be relevant factors for board size, as their coefficients are positive and significant. In this respect, Yang et al. (2004) or Coles et al. (2008), for example, confirm a positive and significant relationship between firm age and board size, while Linck et al. (2007) find a positive relationship between both number of business segments and firm age and board size.

On the other hand, with regards to the variables related to the control hypothesis, table 7 shows that all the proxies related to the need for control are significant, except for the dummy representing the separation between the figures of Chairman and CEO. However, the two ownership structure variables do not show the expected results.

If we analyse the two study hypotheses together (model 11), we find that all the variables are significant except firm diversification. The size of the firm, opportunities for growth and age continue to show a positive and significant relationship with board size, supporting the complexity hypothesis. The relationship between firm size and board size also continues to be non-linear. However, there is some improvement regarding the supervision hypothesis proxies, as the four variables are significant in model 11. However, both ownership concentration and managerial ownership and the debt ratio are negative and significant[12]. The negative relation between ownership concentration and board size could be because a shareholder who increases his proportion of ownership simultaneously acquires more power. This could generate conflicts of interest between the primary shareholder and others with minority holdings (Kim et al., 2007). On these occasions, therefore, the board may have to act as a

[11] This value of 2,791,933million euros corresponds to a Neperian logarithm of 21.75

[12] Ning et al. (2007) cite several studies which confirm a negative relationship between ownership concentration and board size. Likewise, both Ning et al. (2007) and Yang et al. (2004), among others, present evidence of a negative and significant relationship between debt ratio and board size.

control mechanism, not between shareholders and managers but between the shareholders themselves[13], thus adopting a smaller structure to enable greater efficiency in the monitoring function.

Another explanation of the negative relationship between ownership concentration and board size, however, is provided by Denis and Denis (1994). They suggest that majority shareholders value "unilateral control", for which they prefer smaller boards, which area easier to dominate. Likewise, Baglioni and Colombo (2009) point out that major shareholders may be interested in a board structure that provides them with control over firms, in order to obtain private profits, for which smaller boards preferred[14].

Finally, the coefficient related to the separation of the figures of Chairman and CEO is positive and significant, implying that it acts as a control mechanism in itself, in which case the board can be larger.

(Insert Table 7)

Determinants of board composition

Below we have used the same models, but in this case including the percentage of independent members as a dependent variable.

(Insert Table 8)

Table 8 shows the results of the complexity hypothesis variables when the dependent variable is the percentage of independents. The coefficients of Q and the diversification variable are positive and significant, confirming the results found in Baysinger and Hoskisson (1990), Boone et al. (2007), Coles et al. (2008), and so on, where there is evidence of a positive relationship between diversification and the number of outsiders, or those found in Yang et al. (2004), with a positive relationship between opportunities for growth and the percentage of outsiders. This means that, as a firm increases its opportunities and/or operates in more segments (becoming more complex), its needs for advice also grow, so the board includes more independents.

Unexpectedly, firm size is negatively and significantly related to the percentage of independents (model 16). However, when analysing the possible quadratic relationship between these variables, we find that $FSIZE^2$ is positive and significant. This shows that there is a non-linear relationship between firm size and independents. As for board size, the regression estimated for the percentage of independents was represented with all the explanatory variables constant at their respective mean values, except for firm size. As shown in graph 2, we find a curved, albeit predominantly positive, relationship between firm size and the percentage of independent board members.

[13] As Kumar (2008) suggests, agency problems can arise between shareholders and managers, majority and minority shareholders and shareholders and creditors.

[14] This argument fits better, however, with the entrenchment theory than with the agency theory.

Initially, the percentage of independents shrinks as a firm grows, reaching its lowest point, at 25.23%, for 54 million euros[15] in assets. From this point on, however, the percentage of independents increases considerably. In this respect, the positive relationship between firm size and independents is predominant; in large firms, as they grow, independents are invited to join the board because of their expertise and broader views. Along these lines, Lehn et al. (2004) also find a quadratic relationship between capital market value and the percentage of insiders on the board.

(Insert Figure 2)

Finally, table 9 shows the effects of the proxies related to the control hypothesis in the regression referring to the percentage of independents. We see that the coefficients of the four variables are negative, showing that there are other control mechanisms so the board's monitoring function is not as necessary, so fewer independents are required. Moreover, the only variable that is not significant is the indebtedness ratio when analysed separately (model 19). These results are in line with those obtained by Li (1994) and Rediker and Seth (1995), who find a negative relationship between ownership concentration and the percentage of outsiders on the board. Also, both Mak and Li (2001) and Linck et al. (2008), among others, confirm a negative relationship between managerial ownership, separation between the figures of Chairman and CEO and the proportion of outsiders on the board.

Finally, model 22 presents the results of the regression when considering the variables of both hypotheses. All the variables are significant and the signs are as expected, except for age of the firm, which is negative and significant. This model shows that, as a firm becomes more complex – more opportunities for growth and diversification – it has more advisory requirements and therefore needs more independents on the board. Also, as there are other control mechanisms, it has less need for the board to act in a supervisory capacity, so fewer independents are required. There is a non-linear relationship between firm size and the percentage of independent board members, so growth in small firms generates a reduction in the number of independents. However, from a certain size on, growth leads to a larger proportion of independents.

(Insert Table 9)

4.3. Robustness Checks: consideration of endogeneity

Endogeneity problem

So far, we have explored the two board dimensions separately. However, there could also be a relationship between the two dependent variables, with board size affecting board composition and vice versa. We now consider the problem of their endogeneity.

There are several alternative ways of doing this. The simplest way, used by Boone et al. (2007) and Linck et al. (2008), consists of including the lag of the other dependent variable in each OLS

[15] A value of 54 million euros is related to a Neperian logarithm of10.900..

(Ordinary Least Squares) regression. There are, however, specific methods for handling endogeneity, such as 2SLS (Two-Stage Least Squares) or 3SLS (Three-Stage Least Squares) models. The former consists of including instrumental variables and performing the regressions by means of ordinary least squares in two stages (2SLS), as contemplated by Mak and Li (2001) or Agrawal and Knoeber (1996). This method is valid but has some disadvantages, as it is difficult to find an appropriate and valid instrumental variable and 2SLS estimators are consistent but not efficient. The endogeneity problem, then, can be approached by a simultaneous equation system using 3SLS methodology, which gives rise to consistent estimators which are asymptotically more efficient than 2SLS estimators (Theil, 1971). The 3SLS method is used by Coles et al. (2008) and Bhagat and Black (2002), among others.

3SLS model and results

A 3SLS model of simultaneous equations was used to consider the possible endogeneity problem between the two dependent variables. To define the two regressions comprising the model's estimation, the explanatory variables used were those used as proxies for our hypotheses. However, when defining the equations, an explanatory variable was eliminated from each one in order to meet the order condition in the system identification problem[16]. Table 10 shows the results of the simultaneous equation system, the coefficients obtained and their significance.

(Insert Table 10)

In the 3SLS model, we see that the board size dependent variable maintains the significance and sign of most of the explanatory variables. With regards to the second equation, however, we find that the significance of several of the relationships obtained in the previous models' regression has vanished, with very poor goodness of fit. Several tests were performed in an attempt to explain these results. In this respect, we found that the simultaneous inclusion of the firm size and board size variables can distort the results, as board size could already be reflecting firm size, thus leading to overlap problems between the effects of the two factors.

(Insert Table 11)

Table 11, which presents the final model estimated by simultaneous equations with 3SLS, shows a degree of equilibrium between these results and those obtained from the previous FGLS models. In the case of board size, most of the results are consistent – except for age, insider ownership, debt and CEO/chairman separation, which appear as non-significant variables. On the other hand, the percentage of independents regression improves considerably, as only managerial ownership and debt are non-significant. There is also a positive and significant relationship between board size and

[16] The business diversification variable was eliminated from the board size regression and the level of indebtedness variable was eliminated from the percentage of independents regression, as they were not significant in some of the previous models.

percentage of independents, implying that board size is a determinant of board composition. Likewise, board size reflects the effect of firm size on the percentage of independents[17].

5. CONCLUSIONS

Issues related to boards of directors have generated growing interest in recent years, largely resulting from different economic and financial scandals. In the academic field, most of the empirical evidence available has focused on analysing the relationship between the board of directors' configuration and business performance, in order to identify an optimal board structure. From an endogeneity perspective, however, there does not appear to be a structure that is appropriate for all organisations, as each firm adjusts the size and composition of its board to its own characteristics and those of the setting in which it operates.

In order to analyse the determinants of board size and composition, this study considered the advisory function and the monitoring function of boards. It argues that, as a firm grows in complexity, its advisory requirements increase, thus requiring larger boards with more independents. On the other hand, the board acts as a control mechanism replacing ownership and leadership structure and the firm's indebtedness structure in its monitoring function. In this regard, if the alternative control mechanisms are weak, the board will have to enhance its role as a supervisory instrument, thus requiring smaller boards with more independents that provide a more efficient monitoring function.

The hypotheses were tested with a sample of Spanish firms trading on the Stock Exchange during the 2004-2007 period. The results support the endogeneity approach, showing that the structure of the board of directors responds to a rational choice process, which considers the specific characteristics and requirements of each firm.

Specifically, the evidence obtained shows that board composition appears to be determined by both corporate complexity and the need for monitoring. Board size, however, appears to depend more on advisory than on monitoring needs. We can therefore conclude that when a greater advisory function is required, firms change both their board size (which grows) and its composition (with a larger proportion of independents). When more monitoring is needed, however, they tend to alter the board's composition, including more independents, unexpectedly maintaining its size.

There is therefore room for further research, including new variables and attempting to confirm, according to the endogeneity approach, that there is no relationship between board configuration and business performance. It could also be interesting to extend the study to consider endogeneity in more detail, considering not only board size and composition as endogenous but also other factors such as ownership structure, performance, etc. Other factors related to corporate governance could also be considered, such as the compensation system applied to board members. Finally, this study could be

[17] This would imply that increases in firm size generally lead to increases in board size, which has a positive and significant impact on the number of independent members.

applied to other types of firm that are not aimed at maximising profits and define their governance structures according to other determinants.

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TABLES AND FIGURES

Table 1.: Hypotheses

HYPOTHESES	BOARD SIZE	% INDEPENDENTS	VARIABLES (PROXIES)	BOARD SIZE	% INDEPENDENTS
Complexity hypothesis (H1)	+	+	Firm Size	+	+
			Opportunities for growth	+	+
			Number of business segments	+	+
			Firm Age	+	+
Control hypothesis (H2) ***(existence other control mechanisms)***	+	-	Managerial Ownership	+	-
			Concentration of capital	+	-
			Level of indebtedness	+	-
			Separation between Chairman and CEO	+	-

Table 2.: Sectoral distribution of the sample (N = 171)

Sector	CNAE 93 codes	No. of firms	Percentage of total sample
(1) Property and rental activities and business services	70, 71, 72 and 74	59	34.5%
(2) Financial intermediation	65 and 67	11	6.43 %
(3) Transport and communications	60, 62, 63 and 64	8	4.68 %
(4) Retail trade, catering and other services	51, 52, 55, 85, 92 and 93	16	9.36%
(5) Construction	45	13	7.60%
(6) Production and distribution of electricity, gas and water	40 and 41	10	5.85%
(7) Manufacturing industry	15, 17, 18, 21, 22, 23, 24, 26, 27, 28, 29, 31, 32, 33 and 35	49	28.66%
(8) Mining and farming, livestock breeding, hunting and forestry	1, 10 and 14	5	2.92%
Total		171	100%

Table 3.: Descriptive Statistics of board's variables (N = 171, T = 4)

Variable	Definition	Mean	Median	Standard Deviation	Minimum	Maximum
Board Size	Number of board's members	9.86	9.00	4.32	1.00	22.00
Insiders	% insiders	23.01	20.00	18.55	0.00	100.00
Outsiders	% outsiders	76.99	80.00	18.55	0.00	100.00
Affiliated	% affiliated	43.71	42.86	26.11	0.00	100.00
Independents	% independents	29.07	27.53	21.47	0.00	88.90
Other outsiders	% other outsiders	4.18	0.00	9.79	0.00	60.00

Table 4.: Descriptive Statistics of explanatory variables (N = 171 T=4)

Variable	Mean	Median	Standard Deviation	Minimum	Maximum
FSIZE	12,34	12,29	2,05	6,61	18,09
Q	2.11	1.59	1.76	0.10	11.53
DIV	0,28	0,00	0,45	0,00	1,00
FAGE	42,37	36,56	27,03	0,09	115,89
INS	11,47	0,11	22,01	0,00	98,48
CONC	35,95	26,78	24,80	0,00	100,00
DEBT	0,43	0,45	0,25	0,00	1,43
SEP	0,50	1,00	0,50	0,00	1,00

Table 5.: Matrix of Correlations (N = 171 T = 4)

	FSIZE	*Q*	*DIV*	*FAGE*	*INS*	*CONC*	*DEBT*	*SEP*
FSIZE	1							
Q	0,078*	1						
DIV	-0,082**	0.025	1					
FAGE	0,217***	-0,144***	-0,058	1				
INS	-0,207***	-0,047	-0,055	-0,150***	1			
CONC	0,001	-0,001	-0,154***	-0,154***	0,354***	1		
DEBT	0,399**[*]	-0.017	-0,196***	0,163***	-0,021	0,097**	1	
SEP	-0.230**	0,009	0,090**	-0,115***	-0,149***	0,102**	-0,096**	1

Table 6.: Coefficients and significance (N =171, T = 4)[18]

	Board Size (ln)				
Variable	***Model 1***	***Model 2***	***Model 3***	***Model 4***	***Model 5***
(constant)	-1.521 (0.000)	1.792 (0.000)	1.882 (0.000)	1.489 (0.000)	-1.381 (0.000)
FSIZE	0.411 (0.000)				0.379 (0.000)
Q		0.013 (0.001)			0.024 (0.000)
DIV			0.050 (0.007)		0.049 (0.006)
FAGE				0.004 (0.000)	0.001 (0.004)
INS					
CONC					
DEBT					
SEP					
FSIZE^2	-0.010 (0.000)				-0.009 (0.000)
Wald Chi2	13287.59 (12)	830.44 (11)	495.67 (11)	804.11 (11)	4249.51 (15)
Prob > chi2	0.0000	0.0000	0.0000	0.0000	0.0000

[18] Dummies to identify the different industrial sectors in the sample as well as dummies in order to reflect time-related effects are included in the model.

Figure 1: Estimation of board size according to firm size

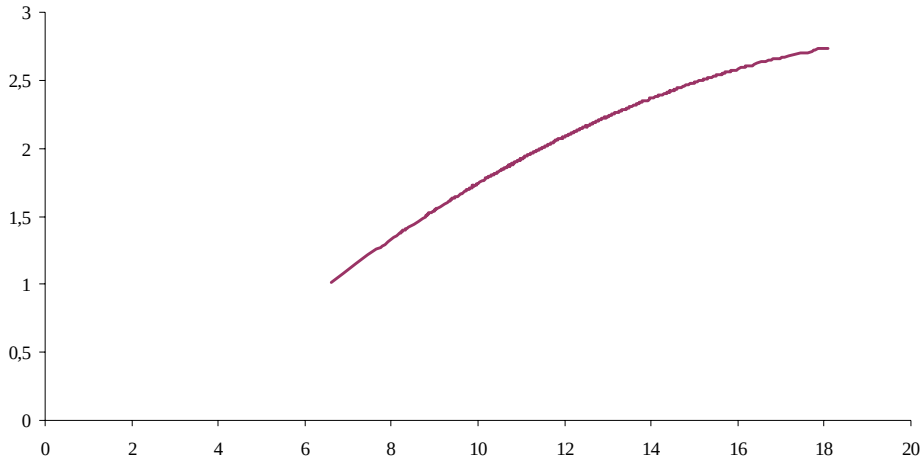

Table 7.: Coefficients and significance (N = 171, T = 4)

	Board Size (ln)					
Variable	***Model 6***	***Model 7***	***Model 8***	***Model 9***	***Model 10***	***Model 11***
(constant)	1.906 (0.000)	1.979 (0.000)	1.828 (0.000)	1.887 (0.000)	1.070 (0.000)	-1.167 (0.000)
FSIZE						0.348 (0.000)
Q						0.016 (0.000)
DIV						0.020 (0.205)
FAGE						0.001 (0.000)
INS	-0.001 (0.002)				-0.001 (0.048)	-0.001 (0.050)
CONC		-0.003 (0.000)			-0.003 (0.000)	-0.003 (0.000)
DEBT			0.249 (0.000)		0.145 (0.000)	-0.219 (0.000)
SEP				0.007 (0.501)	0.035 (0.000)	0.037 (0.001)
FSIZE^2						-0.008 (0.000)
Wald Chi2	381.83 (11)	542.50 (11)	312.57 (11)	278.89 (11)	3269.09 (15)	5753.52 (19)
Prob > chi2	0.0000	0.0000	0.000	0.0000	0.0000	0.0000

Figure 2: Estimation of percentage of independents according to firm size

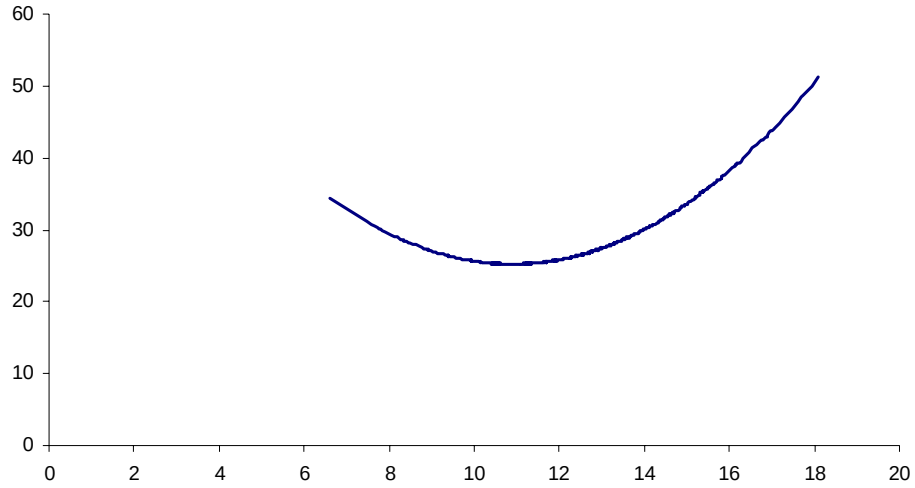

Table 8.: Coefficients and significance (N = 171, T = 4)

	Independents (%)				
Variable	***Model 12*** [19]	***Model 13***	***Model 14***	***Model15***	***Model 16***
(constant)	13.294 (0.552)	1.183 (0.871)	3.747 (0.471)	10.838 (0.069)	59.482 (0.006)
FSIZE	-2.996 (0.377)				-9.203 (0.004)
Q		1.188 (0.001)			1.314 (0.000)
DIV			7.850 (0.000)		6.301 (0.000)
FAGE				-0.060 (0.003)	-0.084 (0.000)
INS					
CONC					
DEBT					
SEP					
FSIZE^2	0.209 (0.115)				0.427 (0.001)
Wald Chi2	176.08 (12)	108.87 (11)	111.93 (11)	116.52 (11)	245.77 (15)
Prob > chi2	0.0000	0.0000	0.0000	0.0000	0.0000

[19] We have run a similar model without FSIZE^2. In this alternative model, the coefficient of FSIZE is positive and significant. .

Table 9.: Coefficients and significance (N = 171, T = 4)

	Independientes (%)					
Variable	***Model 17***	***Model 18***	***Model 19***	***Model 20***	***Model 21***	***Model 22***
(constant)	6.144 (0.292)	8.857 (0.133)	6.581 (0.271)	9.085 (0.134)	13.030 (0.037)	79.892 (0.000)
FSIZE						-10.900 (0.000)
Q						0.995 (0.002)
DIV						5.468 (0.000)
FAGE						-0.121 (0.000)
INS	-0.053 (0.002)				-0.049 (0.001)	-0.053 (0.005)
CONC		-0.126 (0.000)			-0.109 (0.000)	-0.123 (0.000)
DEBT			-2.442 (0.328)		-3.460 (0.157)	-5.286 (0.078)
SEP				-3.918 (0.000)	-3.750 (0.000)	-3.080 (0.000)
FSIZE^2						0.500 (0.000)
Wald Chi2	89.67 (11)	121.08 (11)	91.72 (11)	148.90 (11)	168.28 (14)	352.51 (19)
Prob > chi2	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

Table 10.: 3SLS Model[20]

	Board Size (ln)		Independents (%)	
Variable	***Coefficient***	***Sig.***	***Coefficient***	***Sig.***
(constant)	-0.227	0.017	7.306	0.563
FSIZE	0.541	0.000	-36.785	0.131
Q	0.019	0.065	0.246	0.845
DIV			6.181	0.018
FAGE	0.001	0.253	-0.169	0.002
INS	0.001	0.456	-0.054	0.359
CONC	-0.003	0.009	0.025	0.876
DEBT	-0.099	0.197		
SEP	0.032	0.321	-4.012	0.103
FSIZE^2	-0.015	0.002	1.233	0.068
% Independents	0.002	0.653		
Board Size (ln)			43.812	0.353
R^2	0.5356		-0.3308	
Chi^2 (sig)	684.67 (0.0000)		73.51 (0.0000)	

[20] Dummies to identify the different industrial sectors in the sample as well as dummies in order to reflect time-related effects are included in the model.

Table 11.: 3SLS Final Model [21]

	Board Size (ln)		Independents (%)	
Variable	***Coefficient***	***Sig.***	***Coefficient***	***Sig.***
(constant)	-0.219	0.021	-4.081	0.471
FSIZE	0.446	0.000		
Q	0.021	0.040	0.853	0.098
DIV			8.383	0.000
FAGE	0.001	0.386	-0.114	0.002
INS	0.000	0.527	-0.023	0.605
CONC	-0.003	0.005	-0.143	0.000
DEBT	-0.109	0.156	-2.951	0.464
SEP	0.031	0.327	-3.619	0.043
FSIZE^2	-0.011	0.022		
% Independents	0.001	0.819		
Board Size (ln)			6.818	0.037
R^2	0.5419		0.1280	
Chi^2 (sig)	685.83 (0.0000)		96.59 (0.0000)	

[21] Dummies to identify the different industrial sectors in the sample as well as dummies in order to reflect time-related effects are included in the model.