CORPORATE GOVERNANCE MECHANISMS AND THEIR RELATIONSHIP WITH FIRM PERFORMANCE

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A B S T R A C T

The core purpose of this analysis is to provide evidence about the relationship between the Internal Corporate Governance mechanism and Firm Performance and the relationship between External and Internal Corporate Governance mechanisms. Average Board Age, Board Size, Total Compensation, Managerial Ownership and Ratio of Outsiders compromise the Internal Corporate Governance mechanism. External Corporate Governance mechanism is determined as HHI. I find that Average Board Age is related negatively both with HHI and Firm Performance. Board Size and Managerial Ownership are also positively related with HHI. Finally, I find a positive strong relationship between Board Compensation and Firm Performance.

Keywords:

Corporate Governance Mechanisms, Average Board Age, Board Size, Total Compensation, Managerial Ownership, Ratio of Outsiders, HHI, Firm Performance

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1. Introduction

1.1) Briefing

The interrelationship among a firm's constitutional parties, namely its Directors, Shareholders and Debtholders, is one of the worth-to-mention and rather challenging areas covered by literature on Corporate Governance.

Agency Theory on the other hand, examines the relationship between managers and shareholders the two significant challenges, adverse selection and moral hazard, and attempts to clarify the conflict of interest between shareholders and managers. Separation of ownership and control is the main problem behind it. In theory, it is the shareholder's responsibility to act in manager's best favor. After several scandals in the past 20 years, it seems that shareholders are the first to be affected in case of a firm's bankruptcy, mainly because they find it difficult to align their own interests with the ones of the managers running their organization.

Getting deeper into the Agency Theory, information asymmetry appears between the shareholders and managers. Managers knowing exactly what goes on within the firm, it is obvious that they are in a better position than the shareholders . At the same time, future investors willing to invest in the firm face two important dilemmas concerning their decision. This is because they doubt about the efficiency of corporate governance of each firm. Those dilemmas are linked with management's responsibilities, effectiveness of each firm (adverse selection) and the fair allocation of earnings between shareholders and employees (moral hazard).

A good corporate governance system is of vital importance for firms. Investors to reduce the risk associated with agency theory problems, most of the times focus on the structure of corporate governance of the firm. There is a large number of articles written on corporate governance system and the optimization of its structure. But which is the best combination of corporate governance rules and code and contacts a firm should follow to gain investor's trust? There is no straight forward answer to such a dilemma. There are a lot of factors that determine company corporate governance and its performance.

As Shleifer and Vishny (1997) stated, product market competition is one of the mechanisms able to resolve agency problems between shareholders and managers. Economists support the opinion that managerial slack could be prevented by product market competition. They claim that it is an external mechanism. Allen and Gale (2004), have formalized a model that shows that competition acts as a substitute for an external governance mechanism. Management is forced to take the best possible decisions in order to improve a firm's performance and minimize the risk of default.

On the other hand, Fama and Jensen (1983), claim that board of directors play a fundamental role to corporate governance and the separation of ownership and control. This is an internal corporate governance mechanism and its scope is to ensure that managers act in line with the interests of the shareholders. A way to test the importance of the board of directors in a firm is to check if there is any relation between board characteristics and the performance of the firm.

Most of the studies have focused on the correlation of a firm's performance and its internal corporate governance mechanism. In my study, I provide a clear answer regarding this relationship, using five board characteristics: Board Size, Average Board Age, Ratio of Outsiders, Board Compensation and Managerial Ownership. Additionally, this paper makes a novel contribution to existing literature because the relationship between internal and external mechanisms is also tested. In the next chapters, I determine which is the relationship between Product Market Competition and Board Characteristics and the relationship between Board Characteristics and Firm's Performance. Also, in this analysis some other firm-level characteristics are taken into consideration to test those two relationships. Shareholders, firms and policy makers will be benefited from the results of this paper. They will be able to determine if the structure of their board follows a monitoring role or performs efficiently in a fast-changing competitive environment. This study is also aiming to provide valuable insight on the ways a board could be restructured if such a need existed.

The structure of this analysis is the following: Section 2 coversheet related literature, the hypothesis and the expected outcomes. Section 3 demonstrates the data, the analysis and possible data limitations. Section 4 displays the methodology and measure formation. Section 5 demonstrates the empirical results and elaborates on the robustness checks. Section 6 summarizes and points out limitations and policy recommendations.

2) Literature Review

2.1) Theoretical Considerations & Hypothesis Development

To begin with, it is essential to determine the importance of the board of directors. For most firms, the board is an important tool to resolve the conflicts of interest between decision makers and investors. From this perspective, there is a crucial role of the board of directors, to mitigate possible agency problems stemming from the separation of ownership and control. The Board of director's role can also be determined as a vehicle used to fire, hire and compensate team members and senior managers.

In this point, it is important to acknowledge the neutral position that several economic theories and the corporate laws have maintained concerning the corporate governance structure. For this reason, there is a huge diversity among different board characteristics such as Board Size, Board Average Age, Percentage of Shares Owned from directors, Ratio of Outsiders in the board and Board Compensation levels. Additionally, there are fundamental differences among firms in terms of size, performance, leverage and market capitalization. Due to that, the impact of board characteristics on a firm's performance may vary across different legislation systems and a cross-country study would result to more pragmatic outcomes.

As Jarrad Harford (2005) states, "it is well known that merger waves exist". They have originated from several economical, regulatory or technological shocks within the industries. The aftermath of such mergers is expressed in increased product market competition. As Allen and Gale (2000) argued, "competition can be an option for corporate governance". This is the reason why it can be viewed as an external mechanism to eliminate agency problems. In other words, product market competition could act as a substitute for corporate governance mechanism. The most impressive examples are Toyota Motor Corporation and Honda Motor Company, Ltd, both Japanese, profitable, and successful firms. The interesting part, which makes product market competition a vital ingredient of good corporate governance is that those firms are not well known due to their structure of board. In contrast, they lack monitoring of management, their board size is considerably high and the ratio of outsiders on board is low.

Moreover, the board structure plays a fundamental role for every big or small firm. It could be considered as the most crucial internal mechanism to separate the ownership from the control within firms, and further resolve the agency problem. In this analysis Board Size, will be the first variable used. Working experience of higher aged board members is of vital importance, especially

in cases of competitive and fast changing environments. According to Yermack (1996), there is a negative relationship between firm size and number of directors. Next variable used is Average Board Age. Higher aged directors in general are not in favor of taking risks (Horvath Spirollari, 2012). Among other characteristics Ratio of Outsiders turns to be one of the most significant variables for the analysis of agency problems within the firm, whereas Board Compensation offers important information about the ability of managers to influence executive's behavior. Executive's incentives, seem to increase as the compensation levels increase and this has a positive impact on firm's performance. Finally, the relationship between board share ownership and takeover performance can be tested via the variable Percentage of Shares owned of directors, which is the next element in my analysis.

To sum up, this study investigates two fundamental questions:

H1: *Internal Corporate Governance mechanism is directly related to firm performance*

H2: *External and Internal Corporate Governance mechanisms are related to each other.*

2.2)   Related Empirical Literature

As merger and acquisition waves and the global business world bring more and more attention to corporate governance mechanisms, the question if the structure of the board influences firm performance could be considered as a crucial point of investigation. Light has been given in recent literature mainly due to several financial scandals in US firms, such as Worldcom and Enron collapses.

Board of directors is the main motivator and advisor of management. Its responsibility is to act in favor of shareholder's interests and ensure the monitoring mechanism of managers. By testing the relationship between board characteristics and firm performance evidence is provided for the effectiveness of the structure of the board.

Karuna (2008) advocates that competition is beneficial for corporate governance mechanism up to a specific level. When this level is exceeded, then the external governance mechanism becomes a weak component. In general, not that much literature has been written concerning the relationship between external corporate governance mechanism and board characteristics.

An analysis among five different board characteristics and their expected relationship with firm performance and product market competition follows:

Board Size:

The relationship between board size and firm performance and the level of the optimum board size, have been tested in different studies. However, there are a lot of pros and cons for the number of board members, which makes it unclear. Yermack (1996), investigated a sample of US industrial firms and found a negative relationship between board size and firm performance. In contrast, Dalton et al. (1999), found a positive relationship between board size and firm performance. The same conclusion indicated from Druckeriv (1992). He claimed that the larger the board size is, the more the information is received and the easier to manipulate other members and increase firm performance. The experience in running a business and extract critical resources (such as funding) can lead to higher levels of firm performance and it is easier to be detected in relatively larger boards.

Concerning the relationship between the level of competition and the board size, it is expected that board size will be smaller in more competitive environments. Firms in highly competitive

environment need effective boards (Karuna,2007). Free-riding can be reduced through smaller board size and the decision-making process can be enhanced.

Board Average Age:

Wiersema and Bantel (1992) in their study found evidence on how board average age may play a significant role on firm's strategic decisions. Their sample included 100 different firms in 1983, and the outcome indicates that relationship between Average Board Age and changes in Corporate Strategies turns to be negative. This means that the younger the board members, the more willing they are to take higher risks and therefore accept significant changes concerning the decision-making process. Firm performance is expected to be higher.

To this extent, it is predicted that when competition is high, average board age will also tend to be higher due to the importance of the higher expertise associated with relatively older, and thus more experienced, board members. Sonnenfeld (1992), describes the higher age as an important asset for boards. Moreover, from a strategic-decision making perspective, in a highly competitive and fast-paced environment, older board members can rely on their experience to cope with adverse and unforeseen business situations.

Ratio of Outsiders:

As far as the ratio of outsiders is concerned, Fama and Jensen (1983) advocated that the higher ratio of outsiders on the board can help to minimization of the agency problem and the maximization of shareholder's value. Outsiders are in the best position to judge managerial decisions in a sober way because they do not hold any active role in the company. On the one hand, Sanda, Garba and Mikailu (2008), after testing 205 Nigerian public listed companies found a positive relationship between ratio of outsiders and firm performance. On the other hand, Hafizah (2006) finds that the ratio of outsiders is not directly related with firm performance. His study is focused on 622 financial and non-financial institutions from Malaysia. He also pointed out that the level of financial fraud could be reduced through the increase of the outsiders ratio in board structure.

Randoy and Jensen (2004) studied product market competition in Swedish firms. They claim that there is a positive relationship between the ratio of outsiders on board and the level of competition. Although, outside directors are less valuable and is possible to destroy value for highly competitive

firms. Achim Buchwald (2015) in his study examined European listed firms in the age 2003-2011 and found that the ratio of outside directors in the board, increases the performance of the firm, especially if the product market competition is weak.

Board Compensation:

Higher compensation provides work incentives and increase in the levels of firm performance. Since directors are motivated by compensation schemes, their behavior is influenced by contract terms. Nalebuff & Stigliz (1983) state that compensation is partly determined on relatively performance. Additionally, Kole & Lehn (1997) found that the CEO's compensation is higher after deregulation and in more concentrated structure of ownership.

Vicente and Maria (2004), study the relationship between the product market competition and the several compensation packages that firms offer to their executives. They indicated that the higher the level of product market competition, the more the performance measures given to executives in stock options or bonus.

Managerial Ownership:

Ali, Salleh and Hassan (2008), examined 1000 listed companies and found that there is a positive relationship between the percentage of shares owned and firm performance. At this point, it is significant to clarify that their study is concentrated to non-financial companies since financial companies vary from one industry to another and they can be subject to certain regulations. Morck, Shleifer and Vishny (1988), indicated that the conflict of interest would be lower if managers hold more shares of the company and thus they will be able to manage the business in a relative more successful manner. Therefore, there is a positive relationship between firm performance and percentage of shares owned by its directors.

Unfortunately, there are not enough studies written about the relationship between managerial ownership and product market competition. In competitive industries, there is a vital need of separation of ownership and control so that the conflicts of interest within the firm are minimized and deflated. Karuna (2007) states that the percentage of shares owned by directors is negatively related with the levels of competition.

Table 1: Literature and Expected Results of H1

Table 1 presents the expected results of H1, the name of the author and the period of investigation. In the last column of this table the expected relation between board characteristic and firm performance is observed.

Author's Name	Board Characteristic	Period	Expected Relation with Firm Performance
Yermack	Board Size	1996	(-)
Dalton, Druckeriv		1999,1992	(+)
Wiersema and Bantel	Board Average Age	1992	(-)
Sanda, Garba and Mikailu	Ratio of Outsiders	2008	(+)
Nalebuff & Stigliz	Board Compensation	1983	(+)
Ali, Salleh and Hassan	Managerial Ownership	2008	(+)

Table 2: Literature and Expected Results of H2

Table 2 presents the expected results of H2, the name of the author and the period of investigation. In the last column of this table the expected relation between board characteristic and product market competition is observed.

Author's Name	Board Characteristic	Period	Expected Relation with product market competition
Karuma	Board Size	2007	(-)
Sonnenfeld	Board Average Age	1992	(+)
Randoy and Jensen	Ratio of Outsiders	2004	(+)
Vicente and Maria	Board Compensation	2004	(+)
Karuna	Managerial Ownership	2007	(-)

3. Dataset

3.1) Sample

The sample of this analysis contains US listed firms which are included in the S&P500 index. Data of the sample have been retrieved from an eight-year period between 2007 and 2014. Both lack of available data and several gaps limited the sample size.

For the collection of data three different databases have been used. All three databases have been retrieved from Wharton University of Pennsylvania, in special ISS (former RiskMetrics) and Compustat (2017) which are available online.

Specifically, the first database used for this analysis is mainly focused on board of directors' characteristics and is retrieved from ISS (Former RiskMetrics). The second database used, concerns board compensation and is obtained from Execucomp (2017). Finally, data retrieved to measure firm performance, such as return on assets, was obtained from Compustat IQ-fundamentals (Compustat 2017). All the above-mentioned databases are merged and used as one main Master Database for the regressions and the analysis of the results.

Before getting deeper into data structure and number of observations, it is worth- mentioning that the execution of empirical analysis is done by using the statistical package STATA (2017).

3.2)   Structure of data

Using the initial dataset of board characteristics, variables such as Board Size, CEO Duality, Outsiders Ratio, Average Board Age and Percentage of Shares Owned are generated. The original Compustat sample consists of 98.870 observations. After dropping duplicates, the control variables database consists of 13.312 observations.

Next, the independent variables are generated, using the second dataset retrieved from Compustat. By several commands, Tobin's Q, Return on Assets (ROA), Firm Size and Leverage are generated. Both ROA and Tobin's Q are used to measure Firm's Performance. On the one hand, ROA is calculated as the total Net Income divided by Total Assets. On the other hand, Tobin's Q is a fraction with Total Market Value of Equity plus Book Value of Debt as nominator and Total Value of assets as denominator. The number of observations is 63.527. After the generation of control variables, follows the merge of those two databases. Dependent and Control Variables are merged in one dataset (Merge1) consisting of 10.117 observations.

The original dataset of compensation characteristics consists of 99.305 observations. Financial and utility companies are omitted because of concerns of the role of board of directors, due to different government regulations. Following Yermack (1966), firms with SIC code between 4900 and 4999 (utility sector) and between 6000 and 6999 (financial sector) have been excluded. After dropping missing values and duplicates, the remaining observations are 18.111. In this point, row data from the three different databases have been turned into usable variables. Furthermore, ISS and Compustat databases are merged by fiscal year and CUSIP. The total observations used in our analysis are calculated up to 10.888.

Up to this point enough data are collected for the analysis that will be used both as dependent and control variables. Although, the main sample still misses the indexes that will be used as main independent variables and for robustness checks. Those indexes are the Herfindahl Index and CR4. They will be described in detail in the next chapter. To introduce them to the sample, some adjustments remain to be done.

Firstly, there is a drop of all non-usable data. Secondly, industries are classified by using the 12-industry classification scheme of Fama and French. Table 21, introduces the 12-industry classification separation. Firms fit to industries by SIC Compustat code and the 12-industry categories. By default, when firm industry is not certain, Compustat equals the SIC code to zero and this is the reason why these firms are excluded from the database.

Furthermore, Table 3 presents the time plot of observations. It is observed that the number of observations increases steadily every year after 2007. The reason behind it could be that more and more strict regulations have been established after the financial crisis. Firms were obligated to publish both their reports and the analysis of their board structure.

Table 3: Table of observations

In this table the time series of the sample are reported. Data on board characteristics have been retrieved from ISS (formerly Risk Metrics) for period 2007-2014.

YEAR	# OBSERVATIONS	PERCENTAGE
2007	945	9,37%
2008	1224	12,13%
2009	1269	12,58%
2010	1286	12,75%
2011	1327	13,15%
2012	1350	13,38%
2013	1375	13,63%
2014	1312	13,01%
TOTAL	**10088**	**100%**

Firms with information on board characteristics for more than a year are presented on this sample. Both financial industries and industries providing utilities have been excluded from the sample due to the differences prevailing in their regulatory status.

All variables are winsorized at 1% and 99% level because the sample may be biased from extreme values and outliers. Additionally, multicollinearity is an econometric problem that can affect both the coefficients of the variables and their level of significance. It is often to appear among the explanatory variables in the regressions. In the following Table 4, the level of multicollinearity is tested and a strong correlation between the HHI index and CR4 is evidenced. There is no need for further elaboration as CR4 is solely used for testing robustness.

Table 4: Correlation Matrix

Table 4 indicates the multicollinearity between the variables used for this analysis. The main observation on this table is the level of multicollinearity between variable's coefficients.

	HHI	CR4	ROA	Firm Size	Leverage	Tobin's Q	Market Cap
HHI	1						
CR4	0.8675	1					
ROA	0.0375	0.0713	1				
Firm Size	-0.0483	-0.0655	-0.0420	1			
Leverage	0.0052	-0.0274	-0.3207	0.2668	1		
Tobin's Q	0.0311	0.1021	0.5145	-0.3052	-0.3441	1	
Market Cap	0.0008	0.0363	0.2460	0.8224	0.0060	0.1808	1

3.3) Data Analysis & Possible Limitations

The descriptive statistics of the variables regarding the board of directors suggest that an average company of the sample consists of 9 directors on the board, 78% outsiders (independent directors) with an average age in 62 years. On average, the board of directors has a total compensation of $7.4M per year and the total percentage owned from directors is 91,3%.

Table 5: Summary Statistics

This table indicates the summary statistics for the sample used in the analysis. The sample consists of 10.088 observations and covers US firms in 12 industries. Column 1 shows the number of observations obtained for each year, whilst columns 2-5 depict the summary statistics of the sample. Data are gathered from Compustat – IQ, RiskMetrics and Execucomp for the years 2007 to 2014.

Variables	N	Mean	Sd	Min	Max
Board Size	10,088	9.362	2.379	3	34
Average Age	10,087	62.44	3.677	52.43	72.64
Outsiders Ratio	10,088	0.785	0.111	0.0769	1
Total Compensation	9,775	7.449	1.018	-6.9077	11.76
Total Percentage of Shares	7,763	0.784	2.425	0.001	35.32
HHI	10,088	615.7	599.5	267.5	4.742
CR4	10,088	36.68	13.33	17.79	98.35
ROA	10,088	0.0478	0.0761	-0.512	0.274
Firm Size	10,088	8.065	1.649	4.768	12.76
Leverage	10,088	0.150	0.137	0	0.681
Tobin's Q	10,088	1.443	1.065	0.116	7.532

Table 6: Frequency Histogram

Table 6 reports the frequency of observations across the time-period 2007-2014. Observations obtained concern all the variables tested. Data have been collected from Compustat – IQ, RiskMetrics and Execucomp
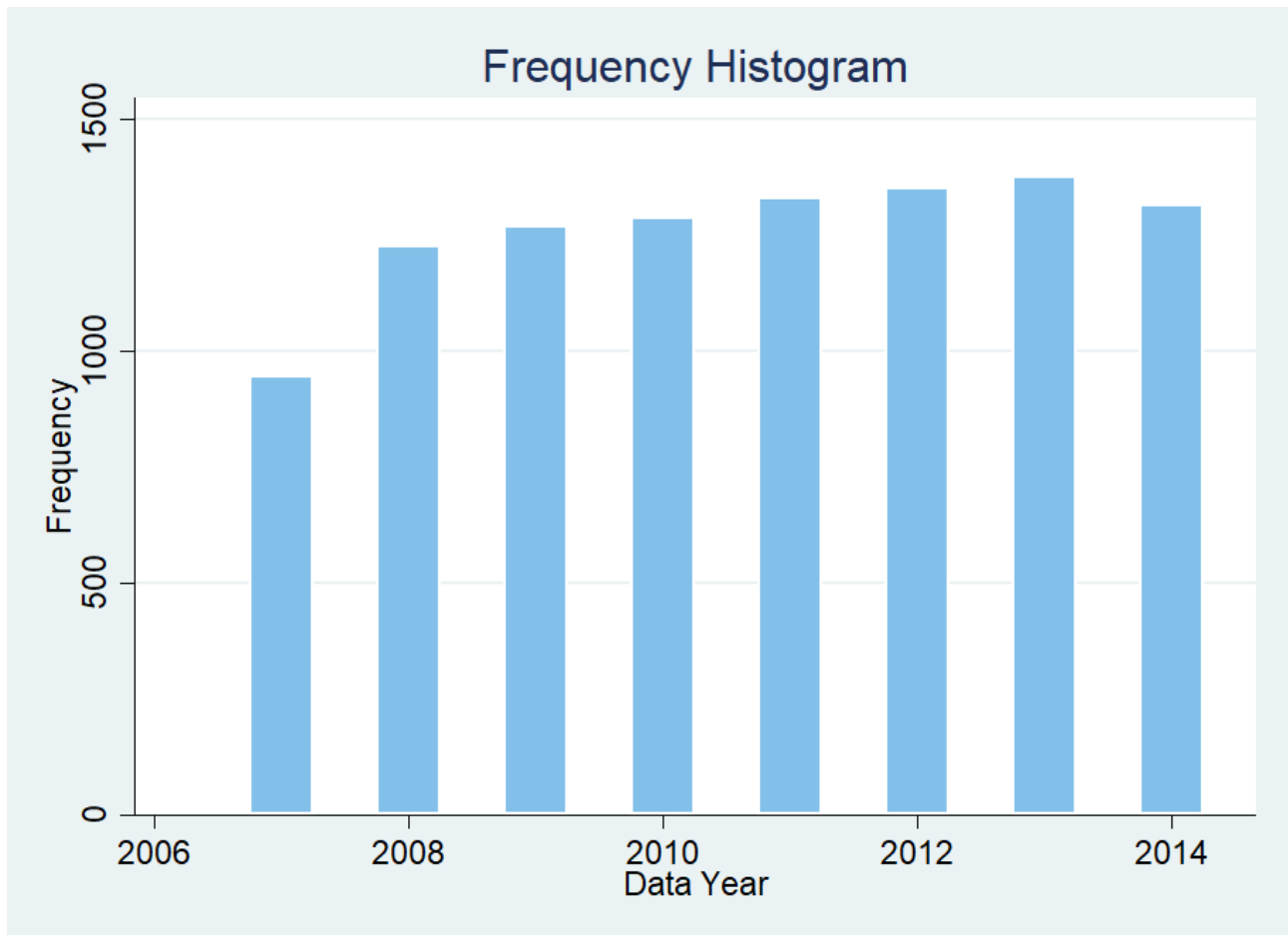

Considering the frequency of the data observed, there is a minimum amount on year 2007 and a maximum one on year 2013. Table 6 indicates that there is a peak of observations in 2013, which is around 1300 observations. However, there is not any large deviation among the years.

The outcomes are considered reasonable, since following 2008, the year that the economic crisis overwhelmed public US firms, more strict regulations have been introduced. As it was previously mentioned, more strict rules were enforced concerning the publication of annual company reports.

Table 7: Frequency Graph Board Size

Table 7 reports the frequency of the number of persons comprise the Board Size in the time spam 2007-2014. Data have been collected from Compustat – IQ, RiskMetrics and Execucomp
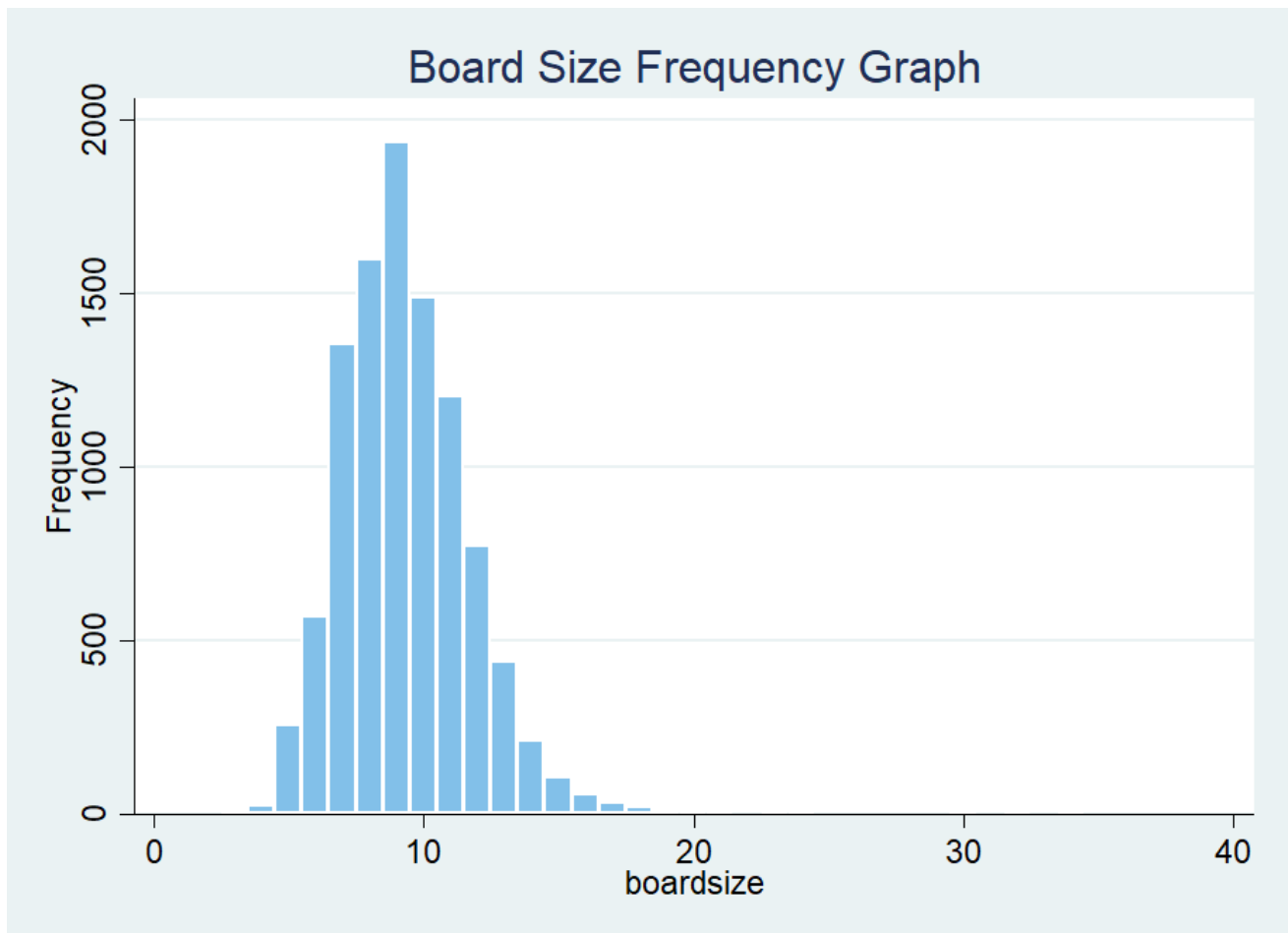
It is observed that board size tends to follow a normalized distribution, with a mean around 9 members. The skewness of the graph is right tailed, which is sensible as it is possible to have exceptional big values even after removing the outliers. Additionally, as explained in table 5, the standard deviation of the board size is 2,379 members.

Table 8: Frequency Graph Average Board Age
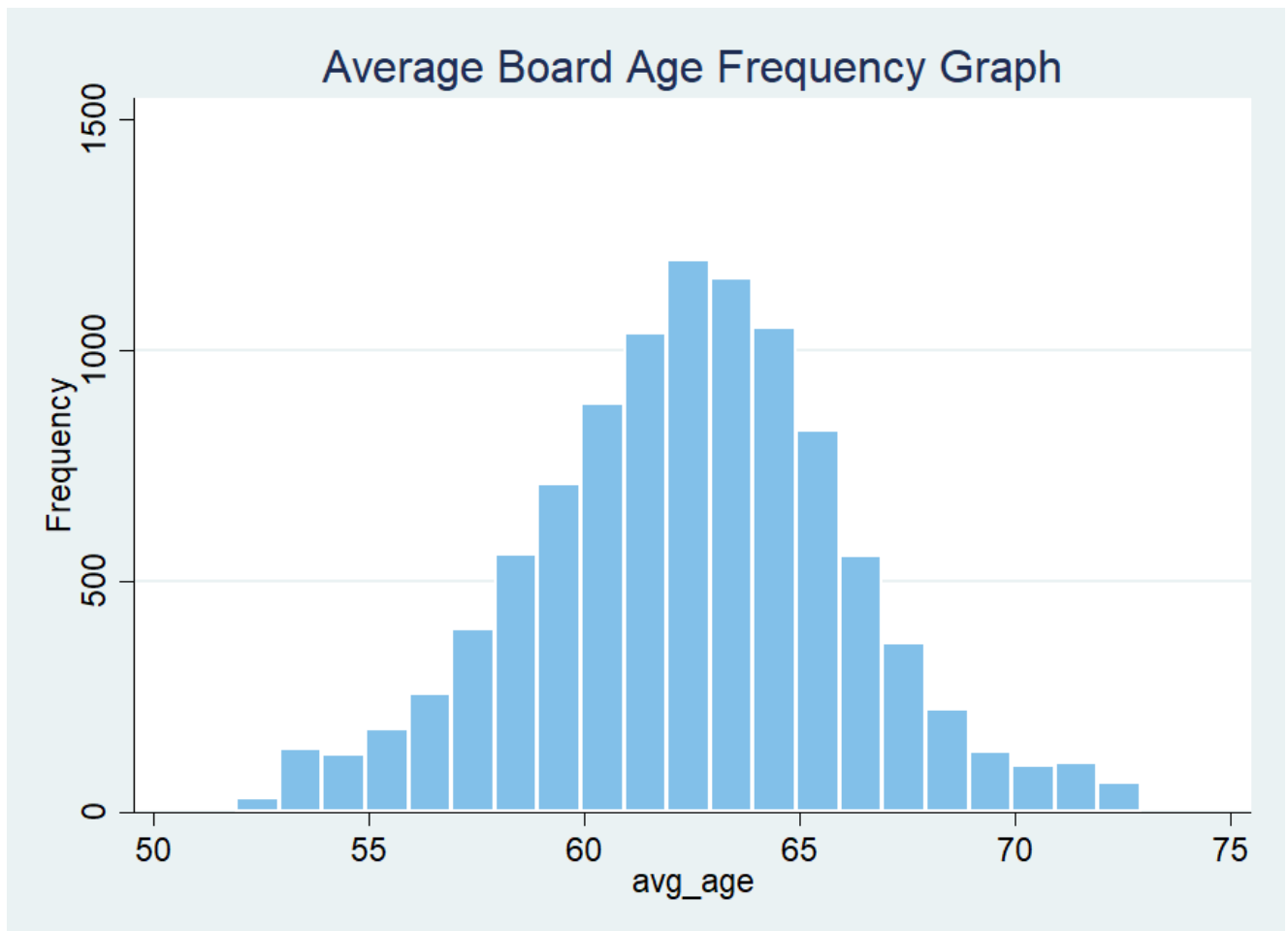
Table 8 reports the frequency of the Average Board Age in the time spam 2007-2014. Data have been collected from Compustat – IQ, RiskMetrics and Execucomp.

It is observed that average board age tends to be closer to a normalized distribution than the Board Size, with a relatively high mean of 62,44 years old. The standard deviation of the Average Board Age is 3,677 years.

$$Mean \pm 2\,(Standard\ Deviation) = \{55,09\,,69,79\}$$

In this case, it can be said that in the span between 55,06 and 69,79, 90% of the population can be found.

Table 9: Frequency Graph Outsiders Ratio

Table 9 reports the frequency of the percentage of Outsiders Ratio in the time spam 2007-2014. Data have been collected from Compustat – IQ, RiskMetrics and Execucomp.
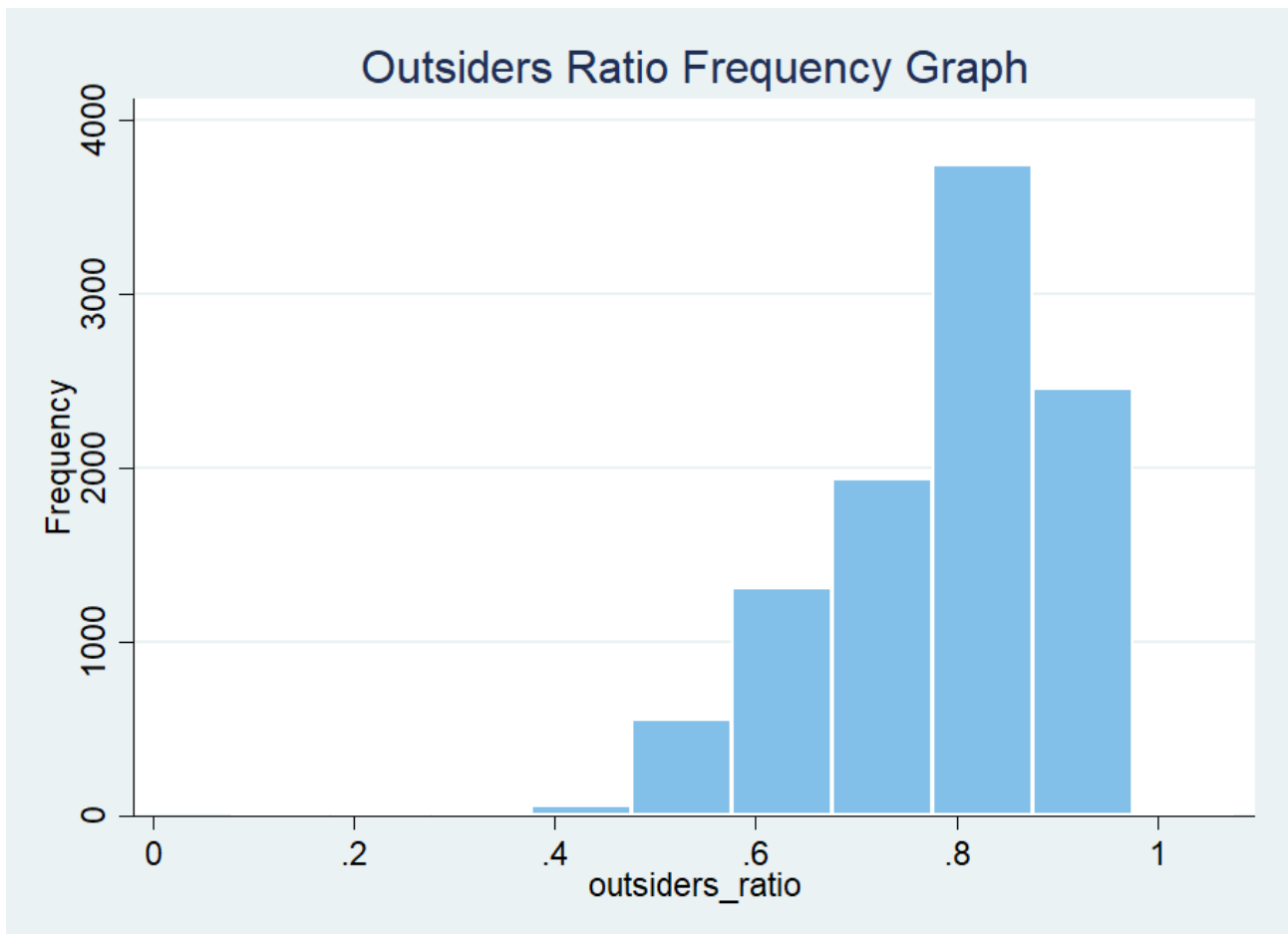

The mean of the Outsiders on the Board is 78,5% which is remarkable as it means that over three out of four members of the board are externals.

Table 10: Frequency Graph Total Compensation

Table 10 reports the frequency of the Total Compensation the board of directors receive in the time spam 2007-2014. Data have been collected from Compustat – IQ, RiskMetrics and Execucomp.
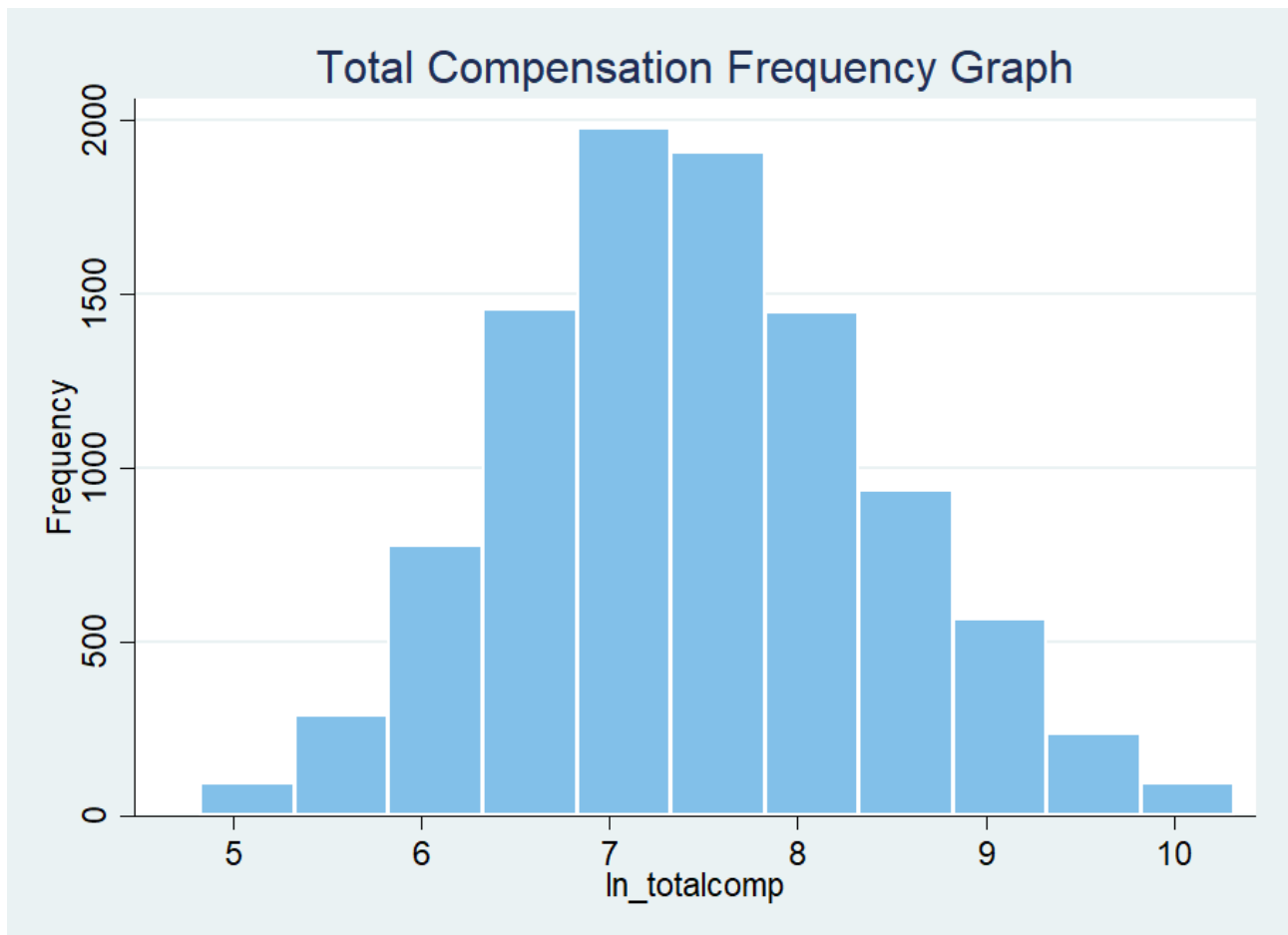
It is observed that the total compensation tends to be closer to a normalized distribution than the Outsiders Ratio and Board Size, with a mean of $7.4M. The standard deviation of the Total Compensation is $1M.

$$Mean \pm 2 \ (Standard \ Deviation) = \ \{6.4, \ 8.4\}$$

In this case, it can be said that in the span between $6.4M and $8.4M, 90% of the total compensation of board of director can be found.

Table 11: Frequency Graph Total % of Shares Owned

Table 11 reports the frequency of the Total % of Shares Owned from directors in the time spam 2007-2014. Data have been collected from Compustat – IQ, RiskMetrics and Execucomp.

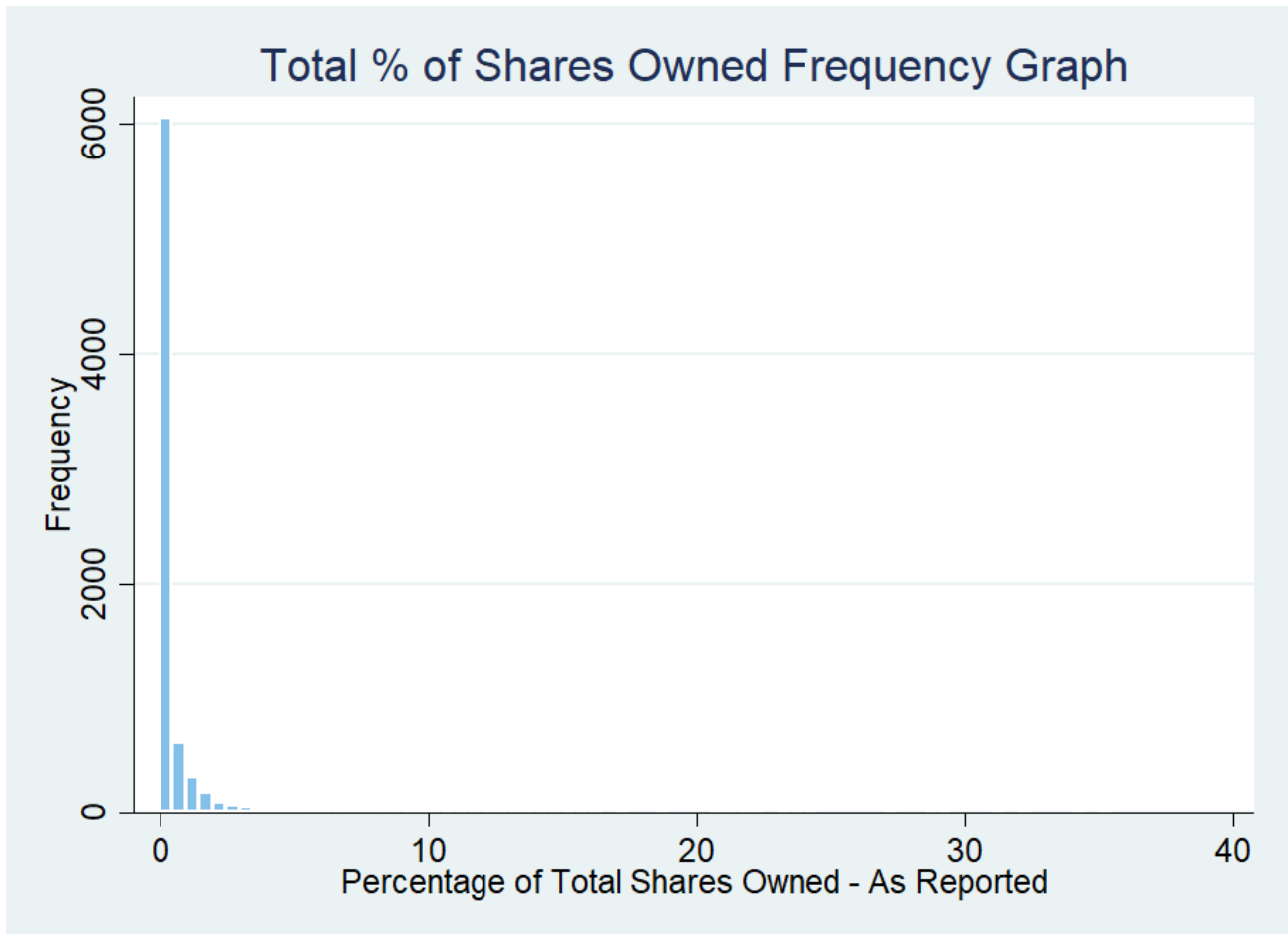In this case, there is no need to elaborate in the % of shares owned of directors, since the mean is equal with 0,784 % which is very low.

4. Methodology

4.1) Explanation and Motivation

This paper examines two fundamental questions. The first one is which is the correlation between internal corporate governance mechanism and firm performance. The second one is the relationship between internal and external corporate governance mechanism.

H1: Internal Corporate Governance mechanism is related with firm performance.
H2: External and Internal Corporate Governance mechanisms are related to each other.

Each firm in our sample is unique. Additionally, there is a one-to-one match between industries and firms in our sample. To investigate the abovementioned hypotheses, regressions in firm level are conducted.

To test the relationship between the Internal Corporate Governance and firm performance, the following regression is constructed:

$$BCHARACT = \beta o + \beta 1 ROA + \beta 2 FirmSize + \beta 4 Leverage + \varepsilon \qquad (1)$$

To test if the External and Internal Corporate Governance mechanisms are related to each other, the following regression is constructed:

$$BCHARACT = \beta o + \beta 1 HHI + \beta 2 ROA + \beta 3 FirmSize + \beta 4 Leverage + \varepsilon \qquad (2)$$

Where *BCHARACT* stands for each one of the five variables that have been analyzed in so far. The *β1* in both cases depicts the interaction between the main independent variable of the regression and each board characteristic.

To examine both the relationship of firm performance and the external corporate governance mechanisms with the internal corporate governance mechanisms the following dependent variables will be used: Board Size, Average board age, Ratio of Outsiders, Board Compensation, Total Percentage of Shares owned from Directors.

To determine the degree of market competition, either Herfindhal-Hirschman Index (HHI) or CR4 could be used. The "top four" concentration ratio (CR4) is an accepted measure for market concentration analysis but there are some considerations which will evolve HHI to be the main measure for competition for this analysis. Firstly, with CR4 the relative size of the four leading companies is not incorporated and secondly the total amount of firms and shares in the market are not considered. On the other hand, HHI provides a better overview since all firms are incorporated, and shares of the larger firms get a higher weigh than those of the smaller ones. Moreover, with the HHI index, it is possible to calculate the missing data because of the weighting procedure. This is to the benefit of the smaller firms, because they usually do not have remarkable market shares (Weinstock, 1982).

To measure the firm performance either ROA or Tobine's Q could be used. For this analysis ROA will be the primary independent variable for firm performance. The difference between the two is that ROA has a numerator of Net Income whilst Tobine's Q numerator calculates the summation of Total Market Value plus Book Value of Dept. Both indexes use Total Assets as denominator.

To robust HHI, CR4 will be used. As mentioned above, this measure shows the proportion of industry sales considering the four largest companies. Industry sales is calculated as the sum of segment sales for companies operating in the industry by using Fama & French 12 industry classification. Tobin's Q and Market Capitalization will be also used to robust ROA and firm size respectively. Table 12 shows the regressions to be used as robustness checks.

Table 12: Regressions for Robustness

This table presents the formulas used to robust the results. In the first regression, to capture the relationship between internal corporate governance and firm performance, Tobin's Q will be used instead of ROA. In the second regression, CR4 will be used as robustness check of HHI. In this way the relationship between the internal and external mechanisms will be tested. In third and fourth regressions, Market Capitalization will be used as control variable instead of Firm Size.

$$1. BCHARACT = \beta o + \beta 1 Tobine's\ Q + \beta 2 FirmSize + \beta 4 Leverage + \varepsilon$$

$$2. BCHARACT = \beta o + \beta 1 CR4 + \beta 2 ROA + \beta 3 FirmSize + \beta 4 Leverage + \varepsilon$$

$$3. BCHARACT = \beta o + \beta 1 ROA + \beta 2 MarkCap + \beta 4 Leverage + \varepsilon$$

$$4. BCHARACT = \beta o + \beta 1 HHI + \beta 2 ROA + \beta 3 MarkCap + \beta 4 Leverage + \varepsilon$$

4.2) Measure Construction

To test the hypotheses, it is crucial to have the appropriate measures for both competition and firm level characteristics.

Test of the relationship between Internal Mechanism and Firm Performance:

To capture Firm Performance, both Return on assets (ROA) and Tobin's Q have been used. The calculation of ROA and Tobin's Q retrieved from Yermack (1996) paper and have been formulized as follow:

$$ROA = \frac{Net\ Income}{Total\ Assets}$$

$$Tobin's\ Q = \frac{Total\ Market\ Value\ of\ Equity + Book\ Value\ of\ Debt}{Total\ Value\ of\ assets}$$

where, the total market value of equity is defined as the total outstanding shares multiplied by fiscal year end stock price. The book value of debt includes both long and short-term liabilities.

Test of the relationship between external and internal mechanism:

For this analysis, competition as a measure is based at industry level according to Chou, Ng, Sibilkov and Wang (2011). Herfindahl Index is used as the main variable for testing the second hypothesis. A small HHI indicates strong competition in the industry, while a larger one implies lower competition and in some cases monopoly.

HHI is computed as the sum of squared market shares and is defined as:

$$\sum_{j=1}^{j} sij^2$$

where *sij* is the market share of company j in industry i. Market share is measured as the company's net sale over total industry sales.

As Tirole (1994) has indicated, HHI is the most common measure of competition and it is very well known in industry organization theory. Its value can range between 0 and 1. The higher the value, the higher the level of concentration of the industry. Monopoly of industry is indicated with an HHI equal to 1, while perfect competition is indicated with 0. In general, a lower than 0.1 score indicates a competitive industry. The primar advantage of Herfindhal Index is that calculates also the small amount of data required for the analysis.

Botosan & Stanford (2005) in their analysis use the four – firm concentration ratio to capture the competition. They also follow Fama & French's industry classification. CR4 is calculated in three steps:

1. Calculate the Sum of Industry Sales, by industry classification and year.
2. Calculate Market share: Firm Sales per industry / Total Industry Sales.
3. CR4: Sum of the market shares of firms which have the highest market shares in the industry.

At this point it is meaningful to refer that according to Barclay & Smith (1995) the highly regulated industries have been excluded because they follow different corporate governance paths. Company agents would be less motivated to achieve growth, since price and thus profits are determined by outsiders.

Table 13: Variables Measurement

Table 13 presents the computation of the variables. The first column presents the name of each variable used for this analysis, the second column presents the name of each variable as referred in STATA and the third one indicates the description of each variable.

Actual Name	Name in Stata	Description
Board Size	Boardsize	The sum of board members
Average Age	avg_age_w	Average age of the directors
Outsiders Ratio	outsiders_ratio	Portion of outsiders to the total number of board members
Total Compensation	ln_totalcomp_w	Total Compensation of board members
Total Percentage of Shares	Shrown_tot_pct_w	Percentage of Total Shares Owned
HHI	HHI_per_industry_100	Sum of the squared markets shares of firms per industry.
CR4	CR4	Sum of the 4 biggest share markets of firms per industry.
ROA	ROA_w	Income divided by assets (total).
Tobin's Q	Q_w	Market Value divided to total assets
Firm Size	Firm_size_w	Logarithm of total assets
Leverage	ml_w	Total debt divided to total assets
Market Capitalization	maketcap_w	Outstanding Shares times Fiscal Year stock end

5. Results

Tables 14-19 depict the results of the regressions. The structure of the equations and the methodology used are based on previous section.

To analyze the results both the statistical and economic significance should be taken into consideration. Concerning the statistical significance, the p-value for each term tests the null hypothesis, where coefficient is equal to zero and therefore there is no effect. A low p-value is likely to be a meaningful addition to the model because changes in the predictor's value are related to changes in the response's variable. On the other hand, a larger and therefore insignificant p-value suggests that changes in the predictor are not associated with changes in the response.

The coefficients of the regression, represent the mean change in the response variable for one unit of change in the predictor variable while holding other predictors in the model constant. By this statistical control, the role of each variable is isolated from the other and this is the key to understand the effect the predictor variable has on the response one.

Another measure to take into consideration for this analysis is the R-squared. It is also known as the coefficient of determination and it determines the percentage of the response variable fluctuation that is explained by a linear model. R-squared is a statistical measure that shows how close the data are to the fitted regression line. In general, the higher the R-squared, the better the model fits at the data.

5.1) H1: Relationship between Internal Mechanism and Firm Performance

Table 14 reports the results from the main regression of H1 which tests the correlation between Internal Mechanism and Firm Performance. Each column represents one different regression with dependent variable each board characteristic. As independent and control variables ROA, Firm Size and Leverage are used respectively.

$$BCHARACT = \beta o + \beta 1 ROA + \beta 2 FirmSize + \beta 4 Leverage + \varepsilon$$

Table 14: Regressions of Firm Performance on Internal Corporate Governance Mechanism.

In table 14 the results from panel regressions are presented. Each column indicates a different regression with dependent variable one board characteristic. Firm fixed effects are also included in the regressions. The significant level of 1%, 5% and 10% are indicated by ***, ** and * respectively.

VARIABLES	Board Size	Average Age	Ratio of Outsiders	Total Comp.	% of Shares owned
ROA	-0.315	-1.176***	-0.0195	0.696***	0.584
	(0.193)	(0.416)	(0.0120)	(0.146)	(0.627)
Firm Size	0.411***	2.142***	0.0336***	0.531***	-0.768***
	(0.0464)	(0.0887)	(0.00299)	(0.0318)	(0.120)
Leverage	0.251	-3.278***	-0.0791***	-1.004***	1.994***
	(0.204)	(0.378)	(0.0129)	(0.141)	(0.624)
Constant	6.029***	45.71***	0.528***	3.288***	6.693***
	(0.366)	(0.712)	(0.0237)	(0.253)	(0.954)
Observations	10,088	10,087	10,088	9,775	7,763
R-squared	0.879	0.850	0.798	0.653	0.434

ROA is statistically significant at 1% level in two regressions. Specifically, ROA coefficient when regressed on Average Board Age and Total Compensation are statistically significant, while it remains insignificant when regressed on Board Size, Ratio of Outsiders and % of shares owned.

$$\textbf{\textit{Average Board Age}} = \textbf{45.71} - \textbf{1.176}\textbf{\textit{ROA}} + \textbf{2.142}\textbf{\textit{FirmSize}} - \textbf{3.278}\textbf{\textit{Leverage}}$$

In the abovementioned regressions, control variables such as Firm Size and Leverage have been successfully used, as their coefficient is statistically significant at 1% level. This indicates that the dependent variable is affected from changes in the control variables.

$$1) \textbf{\textit{Average Board Age}} = \textbf{45.71} - \textbf{1.176} \times \textbf{0,1} + \textbf{2.142} \times \textbf{7,095} - \textbf{3.278} \times \textbf{0,1} = \textbf{60}$$

$$2) \textbf{\textit{Average Board Age}} = \textbf{45.71} - \textbf{1.176} \times \textbf{0,9} + \textbf{2.142} \times \textbf{8,609} - \textbf{3.278} \times \textbf{0,1} = \textbf{63}$$

Using two examples, it is easy to proof that ROA is a statistical significant proxy with big explanatory power for the calculation of Average Board Age. In both examples, Firm Size and Leverage have a small deviation to each other, while ROA deviates a lot. The effect that ROA has on Average Board Age is significant since the difference of those two equations is three years.

As it can be observed from Table 14, the first results show that ROA affects negatively the Average Board Age and positively the Total Compensation. Precisely, if ROA rises by 1-unit, Average Board Age decreases by 1,17 units, while Total Compensation increases by 0,69 units. R-square of both variables suggest that the 85% and the 65% respectively of Average board age and Total Compensation are determined by the independent variables and control variables.

5.2)   H2: Relationship between Internal and External Mechanism

Table 15 reports the results from the main regression of H2 which tests the relationship between Internal and External Mechanism of Governance. Each column represents one different regression with dependent variable each board characteristic. As independent and control variables HHI, ROA, Firm Size and Leverage are used respectively.

$$BCHARACT = \beta o + \beta 1 HHI + \beta 2 ROA + \beta 3 FirmSize + \beta 4 Leverage$$

Table 15: Regressions of External Corporate Governance Mechanism on Internal Corporate Governance Mechanism

In table 15 the results from panel regressions are presented. Each column indicates a different regression with dependent variable one board characteristic. Firm fixed effects are also included in the regressions. The significant level of 1%, 5% and 10% are indicated by ***, ** and * respectively.

VARIABLES	Board Size	Average Age	Ratio of Outsiders	Total Comp.	% of Shares owned
HHI	0.000116**	-0.000278***	-7.73e-07	-4.28e-05	0.000414*
	(4.61e-05)	(9.38e-05)	(3.77e-06)	(3.65e-05)	(0.000225)
ROA	-0.311	-1.185***	-0.0195	0.695***	0.592
	(0.193)	(0.416)	(0.0120)	(0.146)	(0.625)
Firm Size	0.426***	2.105***	0.0335***	0.525***	-0.720***
	(0.0471)	(0.0901)	(0.00304)	(0.0323)	(0.124)
Leverage	0.237	-3.243***	-0.0790***	-0.998***	1.913***
	(0.204)	(0.378)	(0.0130)	(0.141)	(0.612)
Constant	5.837***	46.17***	0.529***	3.360***	6.062***
	(0.378)	(0.736)	(0.0246)	(0.261)	(1.040)
Observations	10,088	10,087	10,088	9,775	7,763
R-squared	0.879	0.850	0.798	0.653	0.435

HHI is statistically significant in three regressions. Specifically, HHI coefficient when regressed on Board Size, Average Board Age and % of Shares owned are statistically significant, whereas for Ration of Outsiders and Total Compensation remains statistically insignificant.

$$Average\ Board\ Age = 46,17 - 0,0002 HHI - 1,185 ROA + 2,105 FirmSize - 3,243 Leverage$$

In the abovementioned regressions, control variables such as ROA, Firm Size and Leverage has been successfully used, as their coefficient are statistically significant at 1% level. This indicates that the dependent variable is affected from changes in the control variables.

1) $Average\ Board\ Age = 45.17 - 0,0002 \times 0,1 - 1,185 \times 0,1 + 2,105 \times 7,5 - 3,243 \times 0,1 = 60,5$

2) $Average\ Board\ Age = 45.17 - 0,0002 \times 0,9 - 1,185 \times 0,1 + 2,105 \times 7,5 - 3,243 \times 0,1 = 60,5$

Two examples are used to check if HHI is a statistical significant proxy with big explanatory power for the calculation of Average Board Age. In both examples, ROA, Firm Size and Leverage has no deviation to each other, while HHI deviates a lot. The results show that the Average Board Age does not change at all and this is due to the very small coefficient of the HHI. The explanatory power of HHI is not big.

As it can be observed from Table 15, the first results show that HHI affects negatively the Average Board Age and positively the percentage of Shares Owned by directors. Precisely, if HHI rises by 1-unit, Average Board Age decreases by 0,0002 units, while % of shares owned increases by 0,0004 units. R-square of both variables suggest that the 85% and the 43% respectively of Average board age and % of shares owned are determined by the independent variables and control variables. As far as the R-square of % of shares owned from directors is concerned, it is significantly low. In this case, this is not a problem, since the statistical significance of the predictors is high enough. Important conclusions on how changes of the predictor values are associated with changes in the response value can still extract important conclusions.

5.3) Robustness Checks for ROA, HHI and Firm Size

In this section, tables 16-19 present regressions with robustness checks for the two main independent variables (ROA and HHI) and the main control variable (Firm Size). The results are robust by computing the variables alternatively. More specifically, Return on Assets is measured with Tobine's Q, HHI is measured with CR4 and Market Capitalization is measured with Firm Size.

5.3.1) Robustness H1: Relationship between Internal Mechanism and Firm Performance with Tobine's Q.

Table 16 reports the results from the robustness regression of H1 which tests the relationship between Internal Mechanism of Governance and Firm Performance. Each column represents one different regression with dependent variable each board characteristic. As independent and control variables Tobine's Q, Firm Size and Leverage are used respectively.

$$BCHARACT = \beta o + \beta 1 Tobine's\ Q + \beta 2 FirmSize + \beta 4 Leverage + \varepsilon$$

Table 16: Regressions of Tobine's Q on Internal Corporate Governance Mechanism

In table 16 the results from panel regressions are presented. Each column indicates a different regression with dependent variable one board characteristic. Firm fixed effects are also included in the regressions. The significant level of 1%, 5% and 10% are indicated by ***, ** and * respectively.

VARIABLES	Board Size	Average Age	Ratio of Outsiders	Total Comp.	% of Shares owned
Tobine's Q	-0.0614***	0.0447	0.00146	0.0671***	-0.117
	(0.0211)	(0.0430)	(0.00142)	(0.0171)	(0.0898)
Firm Size	0.411***	2.121***	0.0331***	0.536***	-0.742***
	(0.0465)	(0.0890)	(0.00297)	(0.0317)	(0.118)
Leverage	0.165	-2.801***	-0.0691***	-1.013***	1.510**
	(0.211)	(0.381)	(0.0131)	(0.145)	(0.654)
Constant	6.115***	45.69***	0.527***	3.184***	6.754***
	(0.363)	(0.709)	(0.0236)	(0.252)	(0.954)
Observations	10,088	10,087	10,088	9,775	7,763
R-squared	0.879	0.850	0.798	0.653	0.434

Tobine's Q is statistically significant in two regressions. Specifically, Tobine's Q coefficient when regressed on Board Size and Total Compensation are statistically significand whereas for Average Board Age, Ration of Outsiders and % of shares owned are statistically insignificant.

Those results contradict the results of the main regression with ROA. It is observed that by using Tobine's Q as the main independent variable, Average Board Age turns to be insignificant, while Board Size becomes significant. Total Compensation of Board members remains significant.

5.3.2) Robustness H1: Relationship between Internal Mechanism and Firm Performance with Market Capitalization.

Table 17 reports the results from the robustness regression of H1 which tests the relationship between Internal Mechanism of Governance and Firm Performance. Each column represents one different regression with dependent variable each board characteristic. As independent and control variables HHI, Market Capitalization and Leverage are used respectively.

$$BCHARACT = \beta o + \beta 1 ROA + \beta 2 MarkCap + \beta 4 Leverage + \varepsilon$$

Table 17: Regressions of ROA on Internal Corporate Governance Mechanism with Market Capitalization

In table 17 the results from panel regressions are presented. Each column indicates a different regression with dependent variable one board characteristic. Firm fixed effects are also included in the regressions. The significant level of 1%, 5% and 10% are indicated by ***, ** and * respectively.

VARIABLES	Board Size	Average Age	Ratio of Outsiders	Total Comp.	% of Shares owned
ROA	-0.448**	-2.267***	-0.0380***	0.388***	0.940
	(0.199)	(0.415)	(0.0124)	(0.149)	(0.630)
Market Cap	0.174***	1.166***	0.0192***	0.317***	-0.396***
	(0.0280)	(0.0532)	(0.00183)	(0.0202)	(0.0851)
Leverage	1.120***	2.007***	0.00654	0.391***	0.196
	(0.207)	(0.410)	(0.0139)	(0.151)	(0.617)
Constant	7.841***	53.04***	0.635***	4.874***	3.856***
	(0.230)	(0.445)	(0.0153)	(0.169)	(0.702)
Observations	10,088	10,087	10,088	9,775	7,763
R-squared	0.878	0.844	0.797	0.650	0.433

ROA is statistically significant in all regressions except of one. Specifically, ROA's coefficient when regressed on Board Size, Average Board Age, Ratio of Outsiders and Total Compensation are statistically significand whereas coefficient of ROA when regressed on % of shares owned remains statistically insignificant.

Those results contradict the results of the main regression which use as control variable Firm Size. It is observed that by using Market Capitalization as control variable, Board Size and Ratio of Outsiders turns to be significant. Only the % of shares owned remains insignificant.

5.3.3) Robustness H2: Relationship between Internal and External Mechanism

Table 18 reports the results from the robustness regression of H2 which tests the relationship between Internal and External Mechanism of Governance. Each column represents one different regression with dependent variable each board characteristic. As independent and control variables CR4, ROA, Firm Size and Leverage are used respectively.

$$BCHARACT = \beta o + \beta 1 CR4 + \beta 2 ROA + \beta 3 FirmSize + \beta 4 Leverage + \varepsilon$$

Table 18: Regression of CR4 on Internal Corporate Governance Mechanism

In table 18 the results from panel regressions are presented. Each column indicates a different regression with dependent variable one board characteristic. Firm fixed effects are also included in the regressions. The significant level of 1%, 5% and 10% are indicated by ***, ** and * respectively.

VARIABLES	Board Size	Average Age	Ratio of Outsiders	Total Comp.	% of Shares owned
CR4	0.0101***	-0.0143**	-0.000431**	-0.00298	-0.0127
	(0.00317)	(0.00596)	(0.000219)	(0.00215)	(0.0137)
ROA	-0.331*	-1.153***	-0.0188	0.484***	-0.126
	(0.193)	(0.416)	(0.0121)	(0.141)	(0.580)
Firm Size	0.435***	2.107***	0.0325***	0.539***	-1.004***
	(0.0471)	(0.0900)	(0.00305)	(0.0325)	(0.162)
Leverage	0.211	-3.221***	-0.0774***	-0.912***	2.500***
	(0.204)	(0.378)	(0.0130)	(0.143)	(0.604)
Constant	5.465***	46.51***	0.552***	3.333***	9.023***
	(0.410)	(0.790)	(0.0270)	(0.284)	(1.545)
Observations	10,088	10,087	10,088	9,725	7,759
R-squared	0.879	0.850	0.798	0.648	0.424

$$Average\ Board\ Age = 46,51 - 0,014 \times 9,83 - 1,153 \times 0,1 + 2,107 \times 7,5 - 3,221 \times 0,1 = 60,3$$

$$Average\ Board\ Age = 46,51 - 0,014 \times 0,02 - 1,153 \times 0,1 + 2,107 \times 7,5 - 3,221 \times 0,1 = 60,5$$

In this case, two examples are used to check weather the CR4 is a better proxy than HHI to measure the product market competition, in terms of explanatory power. In both examples, ROA, Firm Size and Leverage has no deviation to each other, while CR4 deviates a lot. The results show again that the Average Board Age has a small change, and this is due to the small coefficient of CR4. It can be observed that the explanatory power of CR4 is not high.

CR4 is statistically significant in three regressions. Specifically, CR4 coefficients when regressed on Board Size, Average Board Age and Ratio of Outsiders are statistically significand while they remain statistically insignificant when regressed on Total Compensation and % of shares owned.

Those results contradict the results of the main regression which use as main independent variable HHI. It is observed that by using CR4 index to measure the product market concentration as control variable, Ratio of Outsiders turns to be significant, and % of shares owned insignificant. Total Compensation also remains insignificant.

5.3.4) Robustness H2: Relationship between External and Internal Mechanism with Market Capitalization

Table 19 reports the results from the main regression of H2 which tests the relationship between Internal and External Mechanism of Governance. Each column represents one different regression with dependent variable each board characteristic. As independent and control variables HHI, ROA, Market Capitalization and Leverage are used respectively.

$$BCHARACT = \beta o + \beta 1HHI + \beta 2ROA + \beta 3MarkCap + \beta 4Leverage + firmFE + \varepsilon$$

Table 19: Regression of External Corporate Governance Mechanism on Internal Corporate Governance Mechanism with Market Capitalization.

In table 19 the results from panel regressions are presented. Each column indicates a different regression with dependent variable one board characteristic. Firm fixed effects are also included in the regressions. The significant level of 1%, 5% and 10% are indicated by ***, ** and * respectively.

VARIABLES	Board Size	Average Age	Ratio of Outsiders	Total Comp.	% of Shares owned
HHI	8.07e-05*	-0.000394***	-2.37e-06	-6.51e-05*	0.000469**
	(4.68e-05)	(9.95e-05)	(3.85e-06)	(3.72e-05)	(0.000222)
ROA	-0.451**	-2.250***	-0.0379***	0.391***	0.913
	(0.199)	(0.414)	(0.0124)	(0.149)	(0.629)
Market Cap	0.180***	1.135***	0.0191***	0.312***	-0.360***
	(0.0282)	(0.0538)	(0.00185)	(0.0204)	(0.0868)
Leverage	1.138***	1.923***	0.00603	0.377**	0.250
	(0.207)	(0.410)	(0.0139)	(0.151)	(0.623)
Constant	7.740***	53.54***	0.638***	4.956***	3.284***
	(0.238)	(0.463)	(0.0159)	(0.176)	(0.759)
Observations	10,088	10,087	10,088	9,775	7,763
R-squared	0.878	0.845	0.797	0.650	0.433

HHI is statistically significant in all regressions except of one. Specifically, the coefficients of CR4 when regressed on Board Size, Average Age, Total Compensation and % of Shares owned are statistically significand whereas when regressed on Ration of Outsiders is statistically insignificant.

Those results contradict the results of the main regression which use as control variable the Firm Size. It is observed that by using Market Capitalization as control variable, Total Compensation turns to be also significant. Board Size, Average Board Age and % of Shares Owned remain to be significant and Ratio of Outsiders insignificant.

5.4) Results Interpretation

Table 20: Literature, Expected VS Actual Results of H1.

Table 20 is an expansion of Table 1 mentioned in the first chapters. Last two columns present the expected results from literature versus the actual results. A positive or negative sign has been added in the last column only if statistical significance results are observed after running the regressions.

Author's Name	Board Characteristic	Period	Expected Relation with ROA	Actual Relation with ROA
Yermack Dalton, Druckeriv	Board Size	1996 1999,1992	(-) (+)	-
Wiersema and Bantel	Board Average Age	1992	(-)	(-)
Sanda, Garba and Mikailu	Ratio of Outsiders	2008	(+)	-
Nalebuff & Stigliz	Board Compensation	1983	(+)	(+)
Ali, Salleh and Hassan	Managerial Ownership	2008	(+)	-

After regressing the Firm Performance in each board characteristic and using as control variables the Firm Size and Leverage, it can be observed that there is a negative relationship between Firm Performance and Board Average Age and a positive one between Firm Performance and Board Compensation. Such outcomes are in line with the expected ones. It has been also found that ROA has a big explanatory power for the regressions.

Table 21: Literature, Expected VS Actual Results of H2.

Table 21 is an expansion of Table 2 mentioned in the first chapters. Last two columns present the expected results from literature versus the actual results. A positive or negative sign has been added in the last column only if statistical significant results are observed after running the regressions.

Author's Name	Board Characteristic	Period	Expected Relation with product market competition	Actual Relation with product market competition
Karuma	Board Size	2007	(-)	(-)
Sonnenfeld	Board Average Age	1992	(+)	(+)
Randoy and Jensen	Ratio of Outsiders	2004	(+)	-
Vicente and Maria	Board Compensation	2004	(+)	-
Karuna	Managerial Ownership	2007	(-)	(-)

After regressing the Product Market Competition in each board characteristic and using as control variables the Firm Size and Leverage, it can be observed that the relationship between Product Market Competition and Board Size and Managerial Ownership is negative, while the relationship between Product Market Competition and Average Board Age is positive. At this point, it is worthwhile to clarify that the higher the HHI, the lower the Product Market Competition. Such outcomes are in line with the expectations.

6. Conclusions:

The core purpose of this analysis is to provide evidence about the impact of various board characteristics to product market concentration and firm performance. The hypotheses development is based on past literature and a variety of databases. Multiple lineal regressions have been applied.

The questions raised during this analysis were two:

H1: Internal Corporate Governance is related with firm performance.
H2: External and Internal Corporate Governance mechanisms are related to each other.

As Internal Corporate Governance five board characteristics have been considered. Firm Performance is captured by ROA. The External Corporate mechanism is the level of concentration of each industry or the Product Market Competition.

It is found that there is a strong, linear and negative relation between Firm Performance and Average Board Age, whereas the relationship between Firm Performance and Total Compensation is positive. These results are in line with the expectations.

A positive relationship is witnessed between Product Market Competition and Average Board Age and a negative one between Product Market Competition and Board Size and Managerial Ownership. All the results are in line with the expectations.

The results of this analysis provide an additional insight to the existing research and bibliography. It may also prove to be beneficial to policy makers and company shareholders in their efforts to decide on critical issues like board size, its optimal size, its effectiveness and ultimately the firm's competitiveness within the challenging, fast changing and dynamic business arena.

Limitations & Recommendations for further research

The following three econometric constraints are to be mentioned:

1. The R-squared value for some of the tested models is low, which implies that the explanatory power of the model in those cases is low. The variability in the data used may be one of the causes.

2. When the relationship between internal and external mechanism is tested, the coefficients of most of the variables have a small economic magnitude. This limits the explanatory power of the independent and control variables to board characteristics.

3. There is a statistical significance to the control variables used to our sample in the vast majority of the cases. However, in some instances there might be limits on the interpretation of the results due to the so-called endogeneity issue. Weighted Least Squares methods can be used for the elimination of endogeneity. Although it is difficult an instrumental variable to be addressed.

Policy recommendations

This study is fruitful both for shareholders and policy makers. It adds significant value to the current bibliography concerning the corporate governance. Most of the existing studies have introduced empirical evidence concerning the board structure and firm performance or the value creation after the several waves of merger and acquisitions.

After testing several elements, there is significant evidence that the competitive landscape plays a fundamental role in the way boards should be structured. The hypotheses examined in this analysis are focused on the relation between internal mechanism and firm performance and the relation between internal and external mechanism.

For a board of directors to keep its monitoring role in competitive environments, it is important to structure its members in the most efficient way. The empirical results have shown that in competitive industries (where the HHI index is low), is recommended to have experienced board members –thus higher average board age. On the other hand, in concentrated industries (where HHI index is high) it is suggested the size of the board to be bigger and the percentage of total shares owned by board executives to be higher.

Summing up, the scope of this study is to provide useful insight to shareholders and policy makers. There are no "rule of thumb" solutions and decision making is often perplexed and a lot of variables are involved. Thus, several additional factors may affect the relationship between board characteristics and level of competition

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Appendix

Table 21: Classification of Industries

Table 21 indicates the separation of 12 industry groups based on the SIC classification code Fama & French (1997).

Industry Classification	4-Digit SIC code
1. Non-Durable Consumer	|0100-0999|2000-2399|2700-2749|2770-2799|3100-3199|3940-3989|
2. Durable Consumer	|2500-2519|2590-2599|3630-3659|3710-3711|3714-3714|3716-3716|3750-3751|3792-3792|3900-3939|3990-3999|
3. Manufacturing	|2520-2589|2600-2699|2750-2769|3000-3099|3200-3569|3580-3629|3700-3709|3712-3713|3715-3715|3717-3749|3752-3791|3793-3799|3830-3839|
4. Energy	|1200-1399|2900-2999|
5. Chemicals	|2800-2829|2840-2899|
6. Business Equipment	|3570-3579|3660-3692|3694-3699|3810-3829|7370-7379|
7. Telecom	|4800-4899|
8. Utilities	|4900-4949|
9. Shops	|5000-5999|7200-7299|7600-7699|
10. Healthcare	|2830-2839|3693-3693|3840-3859|8000-8099|
11. Money	|6000-6999|
12. Others	|4950-4959|4960-4961|4970-4971|4990-4991|