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BOARD OF DIRECTORS' SIZE AND FIRM PERFORMANCE: EVIDENCE FROM NON-FINANCIAL FRENCH FIRMS LISTED ON CAC 40

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Abstract:

The study aims to investigate the relationship between board size and firm's performance for a sample of non-financial French firms listed on the CAC 40 between 2005 and 2017. We estimated the firm's performance using two types of metrics, the accounting-based measures (ROA and ROE) and the market-based measures (Tobin Q and MTB). By applying the panel data regressions (fixed-effects and random-effects), the findings show that there is a positive effect of board size on firm performance. In addition, our results show that the optimal number of the board size should be between 13 and 17 members in order to achieve good performance for non-financial French firms.

Key words: *Corporate Governance, Board Size, Firm Performance, French Firms*

1. Introduction

According to corporate governance literature, corporate governance includes several mechanisms that have significantly proved their effectiveness in reducing conflicts of interest between stakeholders (e.g., Bathala and Rao, 1995; Ingley and van der Walt, 2004; Jouini, 2013; Dey, 2008), reducing opportunistic behavior of management such as earnings management behavior and improving the quality of earnings (e.g., Petra, 2007; Adıgüzel, 2013; Machuga and Teitel, 2007; Liu and Lu, 2007; Mashayekhi and Bazaz, 2010; Kamarudin *et al.*, 2012), mitigating information asymmetry (e.g., Lopatta *et al.*, 2016; Kanagaretnam *et al.*, 2007; Han *et al.*, 2014; Holm and Schøler, 2010; Goh *et al.*, 2016), improving the shareholder value (e.g., Tudway and Pascal, 2006), reducing agency costs (Ibrahim and Abdul Samad, 2011; Florackis, 2008), as well as reducing the firm's risk (e.g., Mathew *et al.*, 2018; John *et al.*, 2008; Chang *et al.*, 2015). In this context, Hassan and Halbouni (2013) suggest that the corporate governance mechanisms have the ability to reduce the domination of managers and their tendency to enhance their own self-interests, and forcing them to act in a way that increases the shareholder value.

In addition, several corporate governance studies have focused on the effectiveness of the board of directors as the most important mechanism used to achieve good governance, noting that there are many specific characteristics of the board's effectiveness such as the size (e.g., Lipton and Lorsch, 1992; Jensen, 1993; Yermack, 1996; Al-Daoud *et al.*, 2016; Rutledge *et al.*, 2016; Sanda *et al.*, 2010; Villanueva-Villar *et al.*, 2016; Andreou *et al.*, 2014; Ahmadi and Bouri, 2017), independence of the board (e.g., Khan *et al.*, 2017; Ahmadi and Bouri, 2017; Makhoul *et al.*, 2017; Jackling and Juhl, 2009; Christensen *et al.*, 2010; Zhao, 2003; Shan and McIver, 2011; Villanueva-Villar *et al.*, 2016; Rutledge *et al.*, 2016), CEO duality (e.g., Ahmadi and Bouri, 2017; Lam and Lee, 2008; Guillet *et al.*, 2013; Rechner and Dalton, 1991; Christensen *et al.*, 2010; Zhao, 2003; Sanda *et al.*, 2010; Hassan and Halbouni, 2013; Manafi *et al.*, 2015; Rutledge *et al.*, 2016; Doğan *et al.*, 2013), gender diversity (Krishnan and Park, 2005; Erhardt *et al.*, 2003; Carter *et al.*, 2003; Julizaerma and Sori, 2012), and the experience of the board of directors members. In this regard, we point out that the studies of corporate governance have paid little attention to the board size comparing to other board characteristics such as independence, and duality of CEO and Chairman.

Relating to the firm's performance, most firms seek to achieve good results which in turn influence the value of the firm in the stock exchange. In this line, we point out that there are many measures used generally by researchers to evaluate the firm performance, some measures are based on accounting such as earnings before interest and tax, earnings per share, return on assets, return on equity, etc (e.g., Dechow, 1994; Sanda *et al.*, 2010; Zhao, 2003; Rechner and Dalton, 1991; Rutledge *et al.*, 2016; Jackling and Juhl, 2009; Ahmadi and Bouri, 2017; Makhoul *et al.*, 2017), and some others are based on the market such as Tobin's Q index and shareholders' equity market value (e.g., Rizwan *et al.*, 2016; Khan *et al.*, 2017; Shan and McIver, 2011; Lam and Lee, 2008).

Several studies have examined the relationship between board of directors' characteristics and firm performance. The present study examines the relationship between board size and the performance of non-financial French firms listed on the CAC 40 during the period 2005-2017.

This paper is organized as follows: Section 2 discusses the theoretical background and hypothesis development. Section 3 clarifies the study methodology. Section 4 presents the results of the study and their discussion. Section 5 provides a conclusion of the study.

2. Theoretical Background and Hypothesis Development

Corporate governance literature indicates that the characteristics of the board of directors that may affect the firm performance are the number of directors in the board, the percentage of independent directors, and the number of annual meetings (Gómez *et al.*, 2017), as well as duplication in the positions of the chief executive officer and the chairman (CEO duality). The size of the board simply represents the number of directors in the board, the firm's size, the complexity of its operations and the structure of its ownership are considered as determinants of the board size (Ronen and Yaari, 2008, p. 242).

Several studies have illustrated the relationship between board size and firm performance in two opposing ways. Fundamentally, the smaller boards of directors are more effective, this view is highly asserted by Lipton and Lorsch (1992) who said "*In fact, the norms of behavior in most boardrooms are dysfunctional*" (Lipton and Lorsch, 1992, p. 66), these norms of behavior discourage the directors from speaking out, especially if they are going to critique the management, they believe that the board size should be limited to ten directors, with a preferred size between eight and nine members. According to Lipton and Lorsch (1992) small boards of directors are likely to be more effective because of the associated advantages, such as the good and smooth interaction between the directors during the deliberations concerning the challenges and problems facing the firm, which fulfills the primary purpose of the deliberations, which is to reach a real consensus.

This point of view is supported by Jensen (1993), that emphasized that small boards are more effective, and the board effectiveness decreases when the number of directors in the board greater than seven or eight members. Moreover, the findings of Yermack (1996) complies with the theory of Lipton and Lorsch (1992), and Jensen (1993) where he argued that even if the oversight capacity of the board increases with the board size, the costs incurred exceed the benefits obtained.

Indeed, several empirical evidences support the point of view of Lipton and Lorsch (1992), and Jensen (1993). The following empirical evidence has shown that there is a negative effect of the board size on firm's performance. In a study of 452 large US industrial firms between 1984 and 1991, Yermack (1996) found that the size of the board of directors is negatively affecting the value of US firms, he reported also that the profitability and operational efficiency of US industrial firms decreases with the increase of the board size. Mashayekhi and Bazaz (2008) based on a sample of Iranian firms listed on Tehran Stock Exchange (TSE) between 2005 and 2006, found that the large size of the boards of directors reduces the performance of Iranian firms. Their findings support the argument that smaller boards of directors are likely to be more efficient in monitoring management. Additionally, the study of Hassan and Halbouni (2013), which was conducted on a sample of 95 UAE listed firms during the period 2008, found that the board size negatively affects the financial performance of UAE firms measured by accounting-based performance measures, while the board size didn't affect the firms' market measured by Tobin's Q.

Furthermore, in a study of US firms listed on the NASDAQ-100 index between 2010 and 2014, Rutledge *et al.* (2016) found that there is a negative relationship between the board size and the performance of US firms as measured by earnings before interest and tax. The study of Al-Daoud *et al.* (2016) which was carried out in the Jordanian firms, listed on the Amman Stock Exchange (ASE) between 2009-2013, also gave similar results to the findings of Lipton and Lorsch (1992), and Jensen (1993) where they found that larger boards of directors are associated with bad performance. Another evidence from Pakistani firms, the study of Khan *et al.* (2017) which was conducted on a sample of Pakistani firms listed on the Karachi stock exchange between 2010 and 2014, concluded that firms with a smaller board of directors featuring better performance. The same result was found in a study of Rizwan *et al.* (2016) that indicated that there is a negative effect of the board size on the accounting performance measures of the Pakistani firms.

In addition, Makhoul *et al.* (2017) also tested the relationship between the board of directors' characteristics and the performance of listed Jordanian firms measured by return on assets and Tobin's Q ratio during the period 2009-2013. They mentioned the existence of a negative impact of the board size on the performance of Jordanian firms. Besides, a study of Gómez *et al.* (2017) performed on a sample of Colombian firms between 2008 and 2014, found also that the board size negatively affects the performance of Colombian firms, measured by return on assets and return on equity.

On the other hand, many studies have shown a positive relationship between board size and firm's performance. According to Van den Berghe and Levrau (as cited in Gómez *et al.*, 2017) the size allows the board of directors to gather greater intellectual capacity and thus improve strategic decision making.

There is much empirical evidence that found a positive effect of the board size on the firm performance. In a study of 93 Nigerian listed firms between 1996 and 1999, Sanda *et al.* (2010) noted that the board size improves the performance of Nigerian firms measured by return on assets, return on equity, Tobin's Q and Price-Earning ratio. They reported that the optimal value of the board of directors' members must be equal to ten members, in order to achieve the effectiveness of the boards. In another study by Andreou *et al.* (2014) based on a sample of maritime firms during the period 1999-2010, they found that the board size improves the firm valuation on the stock market measured by Tobin's Q ratio. Precisely they found that maritime firms with larger boards exhibit higher valuations.

In the same context, a study by Awan and Jamali (2016), based on a sample of Pakistani firms listed on the Karachi Stock Exchange (KSE) between 2005 and 2014, found that the size of the board of directors improves the financial performance of Pakistani firms. Additionally, a study of Rizwan *et al.* (2016) noted that the stock market looks at the board size of Pakistani firms positively, which reflected in their market value. A similar result was found in the study of Villanueva-Villar *et al.* (2016), that was conducted on the Spanish firms listed on the stock exchange during 2005-2012. They concluded that the board's size has the ability to improve the performance of Spanish firms during the crisis period (2009-2012). Furthermore, in a study by Ahmadi and Bouri (2017) focused on the relationship between corporate governance mechanisms and the performance of French firms listed on CAC 40 index during 2011-2013, the findings showed that the board size enhances the performance of French firms.

All this leads us to formulate a hypothesis for the study as below:

Hypothesis: *There is a positive relationship between board size and firm's performance.*

3. Data and Methodology

3.1 Study Sample and Data Collection

This study aims at investigating the relationship between board size and the performance of French firms listed on the CAC 40 index. The sample of the study includes non-financial firms registered in the previous index during 2005-2017. Data was obtained from the reference documents of the firms and involves the consolidated balance sheet, consolidated results statement, as well as corporate governance reports. Some specialized websites such as (*fr.investing.com*) and (*boursorama.com*) have been used to

calculate the market-based performance measures. The firms studied are presented in Annex 1.

3.2 Measurement of study variables

In this section, we will explain the method of calculating dependent, independent, and control variables.

3.2.1 Measurement of the firm's performance

The previous researches on corporate governance related to the firm's performance (e.g., Khan *et al.*, 2017; Rizwan *et al.*, 2016; Doğan *et al.*, 2013; Jyoti, 2017; Guillet *et al.*, 2013; Zhao, 2003; Lam and Lee, 2008; Jackling and Johl, 2009; Makhoul *et al.*, 2017; Al-Daoud *et al.*, 2016; Hassan and Halbouni, 2013; Andreou *et al.*, 2014; Christensen *et al.*, 2010), indicated that the firm performance can be measured by two types of metrics. The first type is the accounting-based performance measures, represented by the rate of return on assets and the rate of return on equity. The second type is the market-based performance measures, represented by Tobin's Q and Market-to-Book value ratio.

The method of calculating the return on assets (ROA) and the return on equity (ROE) complies with the previous studies (e.g., Ahmadi and Bouri, 2017; Al-Daoud *et al.*, 2016; Awan and Jamali, 2016; Hassan and Halbouni, 2013; Jackling and Johl, 2009; Makhoul *et al.*, 2017; Rechner and Dalton, 1991; Rizwan *et al.*, 2016; Rutledge *et al.*, 2016; Sanda *et al.*, 2010; Zhao, 2003), as the following:

ROA = Net income / total assets at end of the year.

ROE = Net income / total shareholders' equity at end of the year.

Furthermore, in order to estimate the market indicators, we followed the previous studies (e.g., Lam and Lee, 2008; Khan *et al.*, 2017; Shan and McIver, 2011; Villanueva-Villar *et al.*, 2016; Rizwan *et al.*, 2016; Hassan and Halbouni, 2013). Thus, we can show the method used to calculate Tobin's Q and Market-to-Book value ratio (MTB) as follows:

Tobin Q = (Market value of shareholders' equity + Book value of firm's liabilities) / Book value of a firm's assets at the year's end.

MTB = Market value of shareholders' equity / Book value of shareholders' equity at the year's end.

3.2.2 Measurement of the board size and control variables

We measured the board size by following prior studies (e.g., Khan *et al.*, 2017; Vafeas, 1999; Ahmadi and Bouri, 2017; Rutledge *et al.*, 2016; Rizwan *et al.*, 2016; Gómez *et al.*, 2017; Jackling and Johl, 2009; Makhoul *et al.*, 2017; Hassan and Halbouni, 2013; Andreou *et al.*, 2014; Christensen *et al.*, 2010) as follows:

BSize: The total number of members of the board of directors at the year's end.

In order to determine the impact of the firm characteristics on firm's performance, we included several control variables such as firm size, firm leverage, firm growth, and firm age. These variables have been used by many studies on corporate governance (e.g., Ahmadi and Bouri, 2017; Christensen *et al.*, 2010; Mashayekhi and Bazaz, 2008; Shan and McIver, 2011; Hassan and Halbouni, 2013; Andreou *et al.*, 2014; Manafi *et al.*, 2015;

Rizwan *et al.*, 2016; Jyoti, 2017). Therefore, we can show the control variables and the method used to calculate them as follows:

Firm size (Size): The natural logarithm of the firm's assets at the end of the year.

Firm's leverage ratio (Lev): The total financial debts divided on the firm's total assets at the end of the year.

Firm growth (Grow): The difference between the firm's sales in the current year and its sales in the previous year divided on the firm's sales in the previous year.

Firm age (Age): The number of years since the firm's incorporation.

3.3 Study Models

After reviewing the theoretical literature and empirical studies, we decided to build several models that exhibit the relationship between board size and various performance measures. We can present the study models in the following equation:

$$ROA_{it} / ROE_{it} / \text{Tobin } Q_{it} / MTB_{it} = \beta_0 + \beta_1 BSize_{it} + \beta_2 Size_{it} + \beta_3 Lev_{it} + \beta_4 Grow_{it} + \beta_5 Age_{it} + \varepsilon_{it}$$

Where:

ROA: the return on assets of the firm at the year's end; ROE: the return on equity of the firm at the year's end; Tobin Q: the market value of firm's assets divided on their book value at end of the year; MTB: the market value of shareholders' equity divided on their book value at end of the year; BSize: the total number of members of the board at end of the year; Size: the natural logarithm of the firm's assets; Lev: the total financial debts divided on the firm's total assets; Grow: the difference between the firm's sales in the current year and its sales in the previous year divided on the firm's sales in the previous year; Age: the number of years since the firm's incorporation; i: represents the firm; t: represents the years (2005, ..., 2017); ε_{it} : represents the error term; β_0 : is an intercept.

Given the nature of the study data, it is best to use the longitudinal data models (Panel data models), which include three models: *pooled regression model* (PRM), *fixed effects model* (FEM), and *random effects model* (REM). The best model is selected using the following statistical tests: *F-test*, *Breusch-Pagan LM test*, and *Hausman test*. We point out that in order to analyze the study data, we used two statistical programs: the SPSS and EViews software.

4. Results and Discussion

4.1 Descriptive statistics

Table 1 presents the descriptive statistics of the study's variables.

The table shows that the mean (median) of the ROA is 4.5% (4.1%) respectively, with a minimum of -7.6% and a maximum of 41.6% and a standard deviation of 3.8%. While the mean (median) of the ROE is 11.7% (12.4%) respectively, with a minimum of -46.7% and a maximum of 91.4% and a standard deviation of 9.9%. The table also shows that the mean (median) of the Tobin Q ratio is 1.354 (1.220) respectively, with a range of 0.772 to 3.231 and a standard deviation of 0.463, suggesting that the market value of non-financial French firms exceeds their book value (high valuation). While the mean (median)

of Market-to-Book ratio is 1.901 (1.656) respectively, with a range of 0.125 to 13.300 and a standard deviation of 1.204, which means that French firm's stocks are overvalued.

Table 1. Descriptive statistics of the study variables

Variable	N	Mean	Median	Min	Max	S. D
ROA	346	0.045	0.041	-0.076	0.416	0.038
ROE	346	0.117	0.124	-0.467	0.914	0.099
Tobin Q	346	1.354	1.220	0.772	3.231	0.463
MTB	346	1.901	1.656	0.125	13.300	1.204
BSize	346	13.676	14.000	6.000	20.000	2.836
Size	346	24.117	24.237	21.831	26.161	0.889
Lev	346	0.231	0.219	0.008	0.525	0.110
Grow	346	0.077	0.044	-0.749	10.219	0.564
Age	346	95.928	88.500	0.000	352.000	72.263

Source: author calculation

In addition, the table shows that the board size of non-financial French firms listed on the CAC 40 has an approximately mean (median) of 14 (14) respectively, with a range of 6.00 to 20.00 members, and a standard deviation of 2.836.

In order to examine the correlation between the study variables we performed the correlation matrix of Pearson. Table 2 illustrates the Pearson correlation matrix and the variance inflation factor values.

Table 2 shows that there is no significant correlation between board size and the different performance measures (ROA: $r = 0.015$, $p > 0.1$; ROE: $r = .003$, $p > 0.1$; Tobin Q: $r = .018$, $p > 0.1$; MTB: $r = -.025$, $p > 0.1$), suggesting that the board size has played no role in improving the performance of non-financial French firms listed on the CAC 40. Furthermore, there is a negative significant correlation between firm size and firm performance measured by ROA, Tobin Q, and MTB respectively (ROA: $r = -.159$, $p < 0.01$; Tobin Q: $r = -.304$, $p < 0.01$; MTB: $r = -.125$, $p < 0.05$).

The table also shows that there is a negative significant correlation between firm's leverage and performance (ROA: Lev: $r = -.255$, $p < 0.01$; ROE: $r = -.173$, $p < 0.01$; Tobin Q: $r = -.344$, $p < 0.01$; MTB: $r = -.309$, $p < 0.01$). In addition to, there is a negative significant correlation between firm's age and performance as measured by ROE, and MTB respectively (ROE: $r = -.106$, $p < 0.05$; MTB: $r = -.16$, $p < 0.01$). On the other hand, the table shows no significant correlation between firm's growth and performance (ROA: $r = -.024$, $p > 0.1$; ROE: $r = .031$, $p > 0.1$; Tobin Q: $r = .018$, $p > 0.1$; MTB: $r = .062$, $p > 0.1$).

Table 2. Pearson correlation matrix and VIFs

	1	2	3	4	5	6	7	8	9	VIFs
1. ROA	1.000									
2. ROE	.831***	1.000								
3. Tobin Q	.534***	.311***	1.000							
4. MTB	.337***	.436***	.721***	1.000						
5. BSize	.015	.003	.018	-.025	1.000					1.136
6. Size	-.159***	-.056	-.304***	-.125**	.340***	1.000				1.182
7. Lev	-.255***	-.173***	-.344***	-.309***	.137**	.234***	1.000			1.178

8. Grow	-.024	.031	.018	.062	.024	-.001	.065	1.000		1.005
9. Age	.003	-.106**	-.020	-.160***	.017	.020	.304***	.020	1.000	1.106

Notes: *P< 0.1; **P< 0.05; ***P< 0.01.

Source: author calculation

However, the application of the ordinary least squares (OLS) method requires the availability of certain conditions, such as the absence of multicollinearity problem. The multicollinearity means "*the existence of a perfect or exact linear relationship among some or all explanatory variables of a regression model*" (Gujarati and Porter, 2008, p. 321). As a result of the multicollinearity, the variances and covariances of OLS estimators become large. Moreover, the estimated standard errors increase dramatically, thereby making the *t* values smaller (Gujarati and Porter, 2008).

The majority of researchers use the VIFs and the correlation coefficient to detect the multicollinearity problem. As a general rule, if the VIF value of a variable exceeds 10, and the correlation coefficient between two regressors exceeds 0.8, then we can say there is a serious problem of multicollinearity (Gujarati and Porter, 2008).

From Table 2 we can see that all correlation coefficients between explanatory variables were less than the value 0.8. The highest correlation coefficient was between board size and firm size ($r = 0.34$, $p < 0.01$), and all VIFs values were less than 10. Thus, there is no evidence of a multicollinearity problem in the regression models.

4.2 Multiple regression results

The regression results are presented in Table 3. The table shows that board size, firm size, firm leverage, firm growth, and firm age explain 54.6%, 41.2%, 93.3%, and 91.9% of the variation in the return on assets, return on equity, Tobin Q ratio, and the Market-to-Book value ratio respectively, for non-financial French firms listed on the CAC 40. The table also shows that F-statistics for all models are significant (ROA: $F = 64.627$, $P < 0.01$; ROE: $F = 37.980$, $P < 0.01$; Tobin Q: $F = 135.709$, $P < 0.01$; MTB: $F = 110.064$, $P < 0.01$), which means that all models are significant.

The hypothesis of the study argues that the larger the number of members of the board of directors the higher will be the return on assets. Consistent with expectations, there is a positive and statistically significant relationship ($\beta = 0.026$, $P < 0.05$) between board size and the return on assets. we can explain this result that the larger the number of directors on the board, the greater experience of the board, thereby making the board more effective. In other meaning, the larger boards of directors bring more intellectual knowledge than smaller boards, which in turn positively affect the firm's performance. This finding agrees with Sanda *et al.* (2010) argument that large boards are more likely to become involved in strategic decision making and help to improve the firm performance.

In addition, this result is contrary to the findings of previous studies such as (Christensen *et al.*, 2010; Mashayekhi and Bazaz, 2008; Hassan and Halbouni, 2013; Rutledge *et al.*, 2016; Makhoulouf *et al.*, 2017; Gómez *et al.*, 2017; Rizwan *et al.*, 2016; Al-Daoud *et al.*, 2016; Andreou *et al.*, 2014), which found that the larger boards of directors are not effective, and it is negatively associated with firm's performance measured by ROA. On the other hand, this result contrasts with the findings of Ahmadi and Bouri (2017), which they didn't find any significant relationship between board size and performance.

The hypothesis argues that the larger the number of the board of directors' members the higher will be the return on equity. Contrary to expectations, there is a positive relationship but not statistically significant ($\beta = 0.014$, $p > 0.1$) between board size and the return on equity. This result contrasts with the findings of some studies such as (Ahmadi and Bouri, 2017; Awan and Jamali, 2016) where they found a positive effect of the board size on the return on equity, and contrasts also with the findings of several studies (e.g., Mashayekhi and Bazaz, 2008; Hassan and Halbouni, 2013; Gómez *et al.*, 2017; Rizwan *et al.*, 2016) which found that the board size negatively affects the firm's performance measured by the return on equity.

As far as the relationship between board size and firm's value is concerned. Contrary to expectations, there is no significant relationship between board size and the market value of non-financial French firms ($\beta = -0.017$, $p > 0.1$). This finding consistent with the results of some studies such as (Hassan and Halbouni, 2013; Manafi *et al.*, 2015; Rizwan *et al.*, 2016), where they didn't find any significant relationship between board size and firm value. Besides, the result is inconsistent with the findings of studies such as (Christensen *et al.*, 2010; Sanda *et al.*, 2010; Andreou *et al.*, 2014; Villanueva-Villar *et al.*, 2016), which found that the board size improves the firm value. In addition, this result contrasts with the findings of studies such as (Khan *et al.*, 2017; Al-Daoud *et al.*, 2016; Makhoul *et al.*, 2017; Yermack, 1996), where they found a negative impact of the board size on the firm value.

Table 3. Board size and Firm performance

Model		(1)	(2)	(3)	(4)
Dependent variable		ROA	ROE	Tobin Q	MTB
Independent variables	Predicted Sign	Coef	Coef	Coef	Coef
BSize	+	0.026** (0.030)	0.014 (0.300)	-0.017 (0.327)	-0.004 (0.830)
Size	+	-0.080** (0.018)	-0.044 (0.236)	0.089 (0.730)	0.187 (0.519)
Lev	-	-0.154*** (0.002)	-0.079 (0.183)	-0.185** (0.039)	-0.162 (0.143)
Grow	+	0.137*** (0.003)	0.220*** (0.000)	-0.018 (0.164)	-0.002 (0.859)
Age	+	0.072 (0.116)	-0.012 (0.801)	1.592*** (0.010)	1.532** (0.040)
Intercept	?	-0.339* (0.059)	-0.198 (0.332)	0.185 (0.459)	-0.019 (0.931)
Estimation		REM	REM	FEM	FEM
Adjusted R ²		0.546	0.412	0.933	0.919
F-statistic		64.627***	37.980***	135.709***	110.064***
Durbin-Watson stat		2.356	2.268	2.095	2.072
No. observations		318	318	318	318

Notes: *P < 0.1; **P < 0.05; ***P < 0.01; In order to eliminate the serial correlation problem detected in the residuals, we used the first order autoregressive model (Cochrane–Orcutt method). Thus, the number of observation N was reduced by 28 observations after the application of the method; The significance level is in parentheses; Standard errors are corrected for heteroskedasticity (White cross-section standard errors & covariance).

Source: author calculation

Finally, the hypothesis of the study argues that there is a positive effect of the board size on the shareholders' equity value. Contrary to expectations, there is no significant relationship ($\beta = -0.004$, $p > 0.1$) between board size and shareholders' equity market value. This finding is inconsistent with the results of Rizwan *et al.* (2016), where they found that the board size positively affects the shareholders' equity market value.

4.3 The optimal board size

The question to be asked, what is the optimal number of board members that enables non-financial French firms achieve the good performance? To answer this question, we divided the boards of directors into three groups. The first group comprises the boards of directors with less than 13 members. The second group comprises the boards of directors that include between 13 and 17 members. The last group comprises the boards that include more than 17 members. By using dummy variables for each different group of the board of directors' size, we can present the results in Table 4 and 5.

Tables 4 and 5 show that F-statistics for all models are significant at $P < 0.01$, thus we can judge that all models are significant.

From Table 4, we see that in the case of group 1 (the boards of directors with less than 13 members), the coefficients of board size dummy variables are negative and statistically significant for models (5) and (6) respectively (ROA: $\beta = -0.269$, $p < 0.01$; ROE: $\beta = -0.195$, $p < 0.05$), while the coefficients of board size dummy variables are negative but not statistically significant for models (7) and (8). Thus, we can conclude that the boards of directors with less than 13 members are associated with bad performance. Almost the same results for group 3, the coefficients of board size dummy variables are negative but not statistically significant for models (5) and (6), while the coefficients of board size dummy variables are negative and statistically significant for model (7) and (8) respectively (Tobin Q: $\beta = -0.430$, $p < 0.01$; MTB: $\beta = -0.421$, $p < 0.01$). This finding indicates that the non-financial French firms that include their boards of directors more than 17 members are undervalued on the stock market.

Table 4. Board size (Group1 and Group3) and firm performance

Model		(5)	(6)	(7)	(8)
Dependent variable		ROA	ROE	Tobin Q	MTB
Independent variables	Predicted Sign	Coef	Coef	Coef	Coef
BSize1 (Group1: <13)	?	-0.269*** (0.000)	-0.195** (0.014)	-0.026 (0.617)	-0.020 (0.629)
BSize3 (Group3: >17)	?	-0.153 (0.216)	-0.195 (0.166)	-0.430*** (0.000)	-0.421*** (0.000)
Size	+	-0.089** (0.014)	-0.052 (0.191)	0.073 (0.777)	0.159 (0.581)
Lev	-	-0.139*** (0.006)	-0.061 (0.330)	-0.171* (0.053)	-0.151 (0.166)
Grow	+	0.138*** (0.003)	0.221*** (0.000)	-0.018 (0.238)	-0.012 (0.460)
Age	+	0.049 (0.321)	-0.036 (0.491)	1.463** (0.018)	1.471** (0.040)

<i>Intercept</i>	?	0.129** (0.049)	0.091 (0.148)	0.011 (0.937)	-0.013 (0.906)
Estimation		<i>REM</i>	<i>REM</i>	<i>FEM</i>	<i>FEM</i>
Adjusted R²		0.555	0.418	0.891	0.907
F-statistic		57.558***	33.476***	77.448***	91.814***
Durbin-Watson stat		2.315	2.249	2.089	2.045

Notes: *P< 0.1; **P< 0.05; ***P< 0.01; BSize1: take 1 if the board size less than 13 members, and 0 otherwise; BSize3: take 1 if the board size larger than 17 members, and 0 otherwise; As a result of the multicollinearity problem, we omitted the variable BSize2 (high correlation between BSize1 and BSize2) and we will run another regression model that includes the variable BSize2 as will be shown later in Table 5; The significance level is in parentheses; Standard errors are corrected for heteroskedasticity.

Source: author calculation

In contrast, we see from Table 5 that the coefficients of board size are positive and statistically significant for all models (9), (10), (11) and (12) respectively (ROA: $\beta = 0.243$, $p < 0.01$; ROE: $\beta = 0.195$, $p < 0.05$; Tobin Q: $\beta = 0.117$, $p < 0.05$; MTB: $\beta = 0.073$, $p < 0.1$). This finding indicates that the optimal size of the board of directors' members should be between 13 and 17 members in order to achieve the firm's good performance.

Table 5. Board size (Group2) and firm performance

Model		(9)	(10)	(11)	(12)
Dependent variable		ROA	ROE	Tobin Q	MTB
Independent variables	Predicted Sign	Coef	Coef	Coef	Coef
BSize2 (Group2: ≥ 13 and ≤ 17)	?	0.243*** (0.000)	0.195** (0.014)	0.117** (0.030)	0.073* (0.089)
Size	+	-0.084** (0.024)	-0.052 (0.205)	0.093 (0.717)	0.170 (0.565)
Lev	-	-0.133*** (0.007)	-0.061 (0.323)	-0.169* (0.053)	-0.152 (0.163)
Grow	+	0.140*** (0.003)	0.221*** (0.000)	-0.019 (0.221)	-0.015 (0.330)
Age	+	0.044 (0.343)	-0.036 (0.466)	1.509** (0.014)	1.526** (0.032)
<i>Intercept</i>	?	-0.114* (0.054)	-0.104 (0.145)	-0.109 (0.473)	-0.108 (0.538)
Estimation		<i>REM</i>	<i>REM</i>	<i>FEM</i>	<i>FEM</i>
Adjusted R²		0.556	0.420	0.885	0.872
F-statistic		67.072***	39.181***	75.021***	66.672***
Durbin-Watson stat		2.323	2.249	2.081	2.040

Notes: *P< 0.1; **P< 0.05; ***P< 0.01; BSize2: take 1 if the board size ranging from 13 to 17 members, and 0 otherwise; The significance level is in parentheses; Standard errors are corrected for heteroskedasticity.

Source: author calculation

5. Conclusion

Several studies of corporate governance such as Lipton and Lorsch (1992), and Jensen (1993) have investigated the relationship between board size and firm's performance. The findings showed that the large boards of directors negatively affect the firm performance, due to the weakness of communication and coordination of tasks.

In our study, we tested the relationship between board size and firm's performance

using panel data models for non-financial French firms listed on the CAC 40 during the period 2005-2017. Our results suggest that contrary to what is found out in the studies of Lipton and Lorsch (1992), and Jensen (1993) we found evidences of a positive effect of the board size on the firm performance. Overall, our results show that the optimal number of members of the board of directors should be between 13 and 17 members in order to achieve good performance for non-financial French firms.

6. References

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7. Appendix

ANNEX 1. Firm's Name and Data availability

Firm's Name	Sector	From	To
LVMH MOËT HENNESSY VUIT..	Consumer Goods	2005	2017
L'ORÉAL		2005	2017
KERING		2005	2017
DANONE		2005	2017
RENAULT		2005	2017
SAINT-GOBAIN		2005	2017
MICHELIN		2005	2017
PEUGEOT		2005	2017
VEOLIA ENVIRONNEMENT		2005	2017
AIRBUS SE	Industries	2005	2017
VINCI		2005	2017
SCHNEIDER ELECTRIC SE		2005	2017
SAFRAN		2005	2017
LEGRAND		2006	2017
BOUYGUES		2005	2017
TOTAL	Energy	2005	2017
CARREFOUR	Consumer Services	2005	2017
ACCOR		2005	2017

PUBLICIS GROUPE		2009	2017
VIVENDI		2005	2017
VEOLIA ENVIRONNEMENT		2005	2017
LAFARGEHOLCIM	Basic Materials	2015	2017
AIR LIQUIDE		2005	2017
ESSILORLUXOTTICA	Health	2005	2017
SANOFI		2005	2017
CAPGEMINI	Technology	2005	2017
ATOS SE		2005	2017
ORANGE	Telecommunications	2008	2017