The Impact of Board Size on Firm Performance: Evidence from Hungary

By

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Abstract

This thesis evaluates the relationship between board size and firm performance among Hungarian joint-stock companies over the period 1992-2011. The results provide evidence of negative impact of board size on firm financial performance proxied by return on assets (ROA). The adverse impact of hiring an additional director to Supervisory Board is much stronger than an additional director to the Management Board, suggesting that costs of having an additional director in Supervisory Board significantly overwhelm benefits from his/her contribution to a company. The impact of board size on performance in large companies is much smaller and close to zero compared to small companies, which can be explained by the fact that large companies need expert advice provided by large boards. Moreover, the findings show that Hungarian companies consider Management Board and Supervisory Board as two separate and fully functioning organs that cannot substitute each other.

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Table of contents

1. Introduction

The board of directors has emerged as a corporate governance mechanism that ameliorates the never-ending agency conflict between shareholders and managers. The boards take the crucial responsibilities for any corporation such as management and supervision of managerial decisions. Given that the presence of a board is legally required in most countries, boards play an important role in corporate governance. Nevertheless, efficiency of the boards may be questionable - it depends on its diverse characteristics, including, but not limited to board size.

Despite the fact that numerous studies, that were mainly conducted in US, have investigated the relationship between board size and firm performance in public corporations during the past thirty years, yet little is known about this relationship in Hungary and more generally in CEE. Thus, the results of the thesis contribute to the literature on firm performance and board characteristics.

This thesis examines how board size affects firm performance, based on the sample of Hungarian joint-stock companies. On the one hand, having large boards is an additional financial burden (directors receive large salaries), combined with reduced effectiveness - the process of decision-making process becomes longer and some of the directors may become free-riders. Yermack (1996) and Eisenberg et al. (1998) provided evidence of negative relationship between board size and firm performance in US and Finnish companies respectively, that supports aforementioned statement. On the other hand, large scale firms might require large boards in order to receive expert advice. In support of this idea, Coles et al. (2008) found that larger boards are associated with better firm performance in large, leveraged and diversified US firms. Having large boards has its advantages and

disadvantages, and it is an empirical question whether size of the board affects firm performance positively or negatively in a given country.

I examine this question using a sample of 6520 Hungarian joint-stock companies from 57 industries over the period 1992-2011 (not all firms have observations for all twenty years), i.e., 40536 firm-year observations. The data was received from Hungarian Tax Authority Database and the Hungarian Registry Court and cleaned by the CEU Labor Project and the CEU Microdata project.

The thesis is organized as follows: Chapter 2 starts with a theoretical analysis of one-tier and two-tier corporate governance systems and roles of boards in each of them, followed by the analysis of Hungarian corporate governance and review of existing empirical and theoretical literature on board characteristics and firm performance. Chapter 3 describes the data that was used in the empirical research, and provides the sources of this data as well as the description of variables and their statistics. Chapters 4 and 5 present the equations and methods used for regressions, as well as main and supplementary results. Chapter 6 concludes the thesis.

2. Theoretical framework

The chapter provides theoretical background of corporate governance structures with a focus on the roles of boards, followed by an overview of corporate governance rules in Hungary. The last section concentrates on a short survey of prior literature about relationship between board characteristics and firm performance.

2.1 The roles of boards

The following section provides an overview of the agency problem and role of boards as a part of the solution to the agency problem. Further it provides a description of main functions of boards and types of corporate governance structures.

Any relationship between two parties where one (the "agent") promises performance to another (the "principal") is potentially subject to the agency problem. In corporate governance this conflict of interests arises between managers ("agents") and firm's owners, its shareholders ("principals"). The essence of the conflict lies in the fact that the managers are motivated by their own interests, whereas their primary function is to make decisions which will maximize shareholders' wealth.

The agency problem in the context of corporations was already recognized by Adam Smith in his *"Wealth of Nations"*:

> The directors of such [joint-stock] companies, however, being the managers rather of other people's money than of their own, it cannot well be expected that they should watch over it with the same anxious vigilance with which the partners in private copartnery frequently watch over their own… Negligence and profusion, therefore, must always prevail, more or less, in the management of the affairs of such a company. (Smith, 2000)

In order to mitigate the agency problem, there are external mechanisms such as threat of takeover, and internal mechanisms such as performance-based compensation. But it is very

difficult to provide optimal incentives that motivate the management due to a multitude of reasons, including, but not limited to possible diffuseness of shareholders, free-rider problem and asymmetric information. Boards are recognized as part of equilibrium (internal) solution to the agency problem and organizational design problem, and are prevalent as well as legally required all over the world (Hermalin and Weisbach, 2003).

In common practice boards have to fulfill two key functions: 1) management of a corporation that implies making decisions about day-to-day operations of the firm; 2) supervisory function that comprises monitoring the firm performance and major business decisions as well as determining the company's objectives and setting strategy to protect the expropriation of capital providers (the owners), as well as advising the key management personnel on the issues listed above. Based on these two key functions of boards, two most widespread corporate governance structures have evolved: the one-tier system (so-called "Anglo-American model") and the two-tier system.

The main feature of the one-tier structure is that one corporate body, i.e., the Board of Directors, must perform both management and supervision. In other words, the board consists of the top management team who manages the firm on a daily basis and non-executive directors who fulfill the function of oversight. This system is prevalent in the USA, the United Kingdom, Canada and India.

In contrast, in the two-tier system, two major functions are fulfilled by two different boards: the Management Board is in charge of the day-to-day management of the corporation, whereas the Supervisory Board is entrusted with monitoring and controlling as well as appointment and removal of the Management Board.[1] This structure originated in Germany in

[1] In two-tier systems, the functions of management and supervision are not always divided clearly, for instance, in cases when the Supervisory board has to provide approval of a major transaction, it is treated as if having the managerial duties as well as duty of oversight.

the second half of nineteenth century and later has been spreading around Europe (Knut Bleicher and Herbert Paul, 1986).

2.2 Hungarian corporate governance

This section focuses on legal aspects of corporate governance in Hungary, and discusses the types of corporate governance systems that Hungarian firms may employ, functions fulfilled by boards and the limits of board size and composition as prescribed by Hungarian legislation.

Corporate governance structure

The major principles of corporate governance in Hungary are provided in the Act IV of 2006 of the Republic of Hungary on Business Associations (the New Companies Act) that replaced the Act CXLIV of 1997 of the Republic of Hungary on Business Associations (the Companies Act) on 1 July 2006.

As a general rule, the New Companies Act prescribes a two-tier corporate governance system with two separate boards: the Management Board, which consists of three to eleven members, and the Supervisory Board composed of three to fifteen members. It must be noted that the previous legislation did not provide for an upper limit for number of members of Management Board.

The section 21 of the New Act, however, provides a possibility for implementation of one-tier system: "*The articles of association of public limited companies may also contain provisions to tender management and supervisory functions upon the Board of Directors (public or private limited companies operated by the one-tier system)*"[2]. Thus, such companies do not have a Supervisory Board and the law requires companies to treat the

[2] *The Act IV of 2006 of the Republic of Hungary on Business Associations* as amended Section 21, sec.4

members of Board of Directors as executive officers. In this case Board of Directors must have from five to eleven members.[3]

The following companies may not opt for a single-tier system and are required to have a Supervisory Board:

- all companies employing an annual average of at least 200 full-time employees;
- any company that is specifically required by the law to have a Supervisory Board in order to protect public property or with respect to the activities pursued by the company. (Kelemen and Partners Attorneys, 2009)

Functions of boards

In Hungary, within the two-tier structure, the functions are distributed in the following way: the Management Board is the governing body which manages the firm's business, owes the legal duty to the company and acts on its behalf. As in Germany[4], the Management Board makes decisions about the day-to-day operations of the company, unless they fall under the competence of the shareholders' meeting or the Supervisory Board. Regarding a representative function, both in Germany and in Hungary, the Management Board is the legal representative of the corporation vis-a-vis all third parties and before the court and other authorities[5]. Board members have to act independently and serve company's interests.

Since Hungarian companies use the two-tier corporate governance system, originated in Germany, the main role of the Supervisory Board - to supervise the Management Board's performance and the business of the company - is the same in both countries. Members of

[3] The dataset used in this thesis does not allow tracking which companies may have opted for one-tier system after 2006, therefore, this legal change shall not be used for identification.
[4] *German Stock Corporation Act*, or *Aktiengesetz*, 2011, §76
[5] *German Stock Corporation Act*, or *Aktiengesetz*, 2011, §78; The Act IV of 2006 of the Republic of Hungary on Business Associations, Part I, Chapter III, Title 2

Supervisory Board revise the firm's financial statements and report the results in the shareholders' meeting. Moreover, according to section 37 of the Act IV of 2006 on Business Associations, shareholders' general meetings can delegate their following responsibilities to the Supervisory Board: appointment and removal of the members of the Management Board as well as establishing their remuneration. The articles of association of private limited companies or the memorandum of association of private limited liability companies may also authorize the Supervisory Board to give its prior consent for certain major resolutions/actions by Management Board. Delegation of these decisions to the Supervisory Board further strengthens its position in performing its supervisory function.

In contrast, in the United States, where companies use one-tier corporate governance system, the Board of Directors is in charge of duties of both Management Board and Supervisory Board.[6] It is the same as in Hungarian companies that are controlled by the one-tier system.[7]

Composition of boards

In the United States, the majority of the Board of Directors in companies listed on the national stock exchanges has to be independent.[8] As a rule, the insider (executive) director is a full-time employee of the firm, whereas the directors that are primarily employed outside of the firm are deemed independent (outside) directors (Adams, Hermalin and Weisbach, 2010).[9] The Hungarian Law, as well as German Stock Corporation Act, does not distinguish between non-executive or independent and executive Management board members. Nevertheless,

[6] *Delaware General Corporation Law*, Chapter 1, Subchapter II, §141; Model Business Corporation Act (with selected Official Comments), Chapter 8, Subchapter A, §8.01

[7] *The Act IV of 2006 of the Republic of Hungary on Business Associations*, Section 308

[8] *Model Business Corporation Act* (with selected Official Comments), Chapter 8, Subchapter A, §8.01

[9] There is also another category of board members called "gray" or "affiliated" which consists of outside directors with conflict of interest (dubious independence), for example, CEO's family members or lawyers and bankers that have business relationship with the company. (Adams, Hermalin and Weisbach, 2010)

according to the BSE Recommendations, the presence of non-executive directors in a Management Board is supported and encouraged in order to ensure independence of the Management Board.[10]

If a firm opts for a one-tier structure, the majority of Board of Directors has to be independent, unless a higher percentage is required by the articles of association.[11]

2.3 Existing literature on the relationship between board characteristics and firm performance

This section discusses empirical and theoretical literature on the impact of board characteristics, such as composition and size, on firm performance.

Starting with the effect of board composition on company performance, the results of diverse empirical studies are ambiguous. Borokhovich, Parrino, and Trapani (1996), Brickley, Coles, and Terry (1994) and Byrd and Hickman (1992) all argued that independent directors serve shareholders' interests and, consequently, the percentage of independent directors in a board is positively correlated with firm performance. On the contrary, Yermack (1996) and Coles et al (2008) found a negative impact of percentage of outside directors and that Tobin's Q[12] increases with the number of insider directors. Meanwhile, Bhagat and Black (1999; 2000) and Dalton et al (1998) provided no convincing evidence that board composition has an impact on firm profitability. It must be noted that all these papers investigated US corporations.

[10] *COMMISSION RECOMMENDATION* of 15 February 2005 on the role of non-executive or supervisory directors of listed companies and on the committees of the (supervisory) board

[11] *The Act IV of 2006 of the Republic of Hungary on Business Associations* as amended Section 309, sec 2.

[12] Tobin Q is a measure of firm value, calculated as book assets minus book equity plus market value of equity all divided by book assets. (Coles et al, 2008)

The size of the board is another important characteristic. The relationship between board size and firm performance has received much attention in the prior literature. For example, Lipton and Lorsch (1992) and Jensen (1993) argued that board size plays an important role in corporate governance irrespective of other characteristics of boards. They emphasized that large boards can be ineffective due to problems in coordination, procedural issues, and director free-riding. In other words, the costs of slower decision-making process (it takes more time to reach consensus in a big group of board members) overwhelm the advantage of additional expert opinion. Moreover, since directors usually get relatively high salaries, having large boards may lead to huge monetary costs, even more, the growth of CEO's compensation may outpace the growth of firm value.[13]

The evidence of negative relationship between board size and firm performance was provided by different empirical research. Yermack (1996) supported the idea of Lipton and Lorsch (1992) showing the negative impact of board size on Tobin's Q in a sample of 500 largest US public corporations. Confirming Yermack's results, Eisenberg et al. (1998) found a significant negative correlation between board size and firm financial performance among small and midsize Finnish companies. Coles et al (2008) documented the negative relationship for simple US firms, but the positive correlation for complex[14] US firms. The authors argued that compared to simple companies, complex ones with many business segments, high leverage and big firm size have greater advising requirements; hence complex firms benefit from large boards. Hans van Ees et al., (2003) investigated this research question in a sample of Dutch companies, which have a two-tier corporate governance system, and found no evidence of a relationship between Management Board size and firm profitability and negative effect of size of Supervisory Board on performance.

[13] For more detailed information, please, check papers of Bebchuk and Grinstein (2005) and Gabaix, Landier and Sauvagnat (2014).

[14] Complex firms are "those that are diversified, those that are large, and those that rely more on debt financing". (Coles et al, 2008)

This literature review shows that there is still little consensus on the question what the relationship is between board size and firm performance, furthermore, this matter has not been researched with respect to numerous countries. Consequently, it is safe to assume that there is a lot of room for research in this area.

3. Data description

The following chapter describes the data used for this research, as well as the sources of this data. The chapter also provides the description of dependent and independent variables and summary statistics.

The research employs a unique database on Hungarian joint-stock companies, created as a result of merging two types of data - firms' financial data and data about employees of such firms.

The primary source of financial data is the Hungarian Tax Authority Database, as cleaned by the CEU Labor Project. This dataset consists of following financial measurements for each company for the period between 1992 to 2011: sales, pretax and net profits, depreciation, share capital, equity, total assets, total liabilities and number of full-time employees.

The information about employees was initially received from the Hungarian Registry Court, which collects company balance sheets and personal information of employees every year, and cleaned by the CEU Microdata project. Initially, there were two datasets containing the information about employees, both of which contained the information with the following fields: identification number of a firm (ceg_id), identification number of an employee, the first and the last dates at work and his/her position. The first dataset provided information only about members of Supervisory Board, whereas the second one contained information about all employees, excluding members of Supervisory Board. Consequently, the latter dataset was cleaned in order to extract the information regarding members of Management Board. For this purpose, the second dataset was filtered by employees whose positions were "igazgató", "igazgatósági tag", "vezérigazgató", "elnök" and "alelnök" which in Hungarian

mean director, member of a board, CEO (chief executive officer), president and vice-president respectively.

The information about employees was used to calculate the number of members of Supervisory and Management Boards[15] in a certain firm in a certain year. The assumption was that a director works in a certain year, in the company if the date "31 December of year XXXX" falls between the starting date and the ending date of employment, e.g., a director is considered as having worked for this firm in the year 2000, if he was employed at this firm as of 31 December 2000. In case the database did not provide the ending date of employment, it was assumed that such an employee is currently employed by the firm. The last day of a year was used for the calculations due to the fact that no employee had 31 December as neither starting nor ending date, which mitigates the probability of double counting.

After merging all data into one dataset by a unique firm identification number and cleaning the data[16], the final dataset contained a sample of 6,520 Hungarian joint-stock companies from 57 industries[17] for the 1992-2011 period (not all firms have observations for all twenty years), i.e., 40,536 firm-year observations.

A key issue in the analysis of the relationship between board size and firm performance is to choose the performance measure that can be a financial indicator or measure based on market data. The latter category is represented by Tobin's Q which is the ratio of market value of assets to book value of firm's assets. Market values cannot be

[15] The dataset contains two types of boards - Supervisory board and Management Board, which fits the firms that have a two-tier system. However, in cases when the firm chooses a one-tier system and has only one board - Board of Directors, the dataset does not provide for this third option, and includes the Board of Directors into the field of the Management Board. Therefore, the limitations of the dataset require that the Management Board and the Board of Directors are equaled, and referred to as "Management Board".

[16] In order to clean the data I dropped all observations when employment, number of management board members, total asset and sales were equal zero. Note: Number of supervisory board members can be zero, since companies may have one-tier corporate governance system.

[17] A full list of industries studied in this thesis is represented in the Appendix A.

computed from the final dataset, there is no historical market information. Therefore, the choice fell on accounting performance measure - return on assets (ROA) which is defined as

$$ROA = \frac{Pretax\ profit}{Total\ assets}. \quad (1)$$

For assessing the relationship, the following board size variables are considered:

- *Mboard* is the number of members of the Management Board (in two-tier system) or Board of Directors (in one-tier system) in a specific company in a specific year;
- *Sboard* is the number of members of the Supervisory Board in a specific company in a specific year.

In addition to the board size variables, regressions include control variables that are likely to have a direct impact on return on assets. Thus, one of the explanatory variables is *leverage* which is defined as the ratio of total debt to total assets. The bigger the leverage, the higher are interest payables and lower are taxes payables which directly affect the amount of profit, and consequently, ROA.

Moreover, there is a control for size of a firm which is proxied with the log of total asset (*ta*), measured in thousands of Hungarian forints. Another possible proxy for firm size is the log of sales (*sales*), measured in thousands of Hungarian forints, which is used for checking the robustness of the results.

Finally, industry dummies (57 dummies for 57 industries) and year dummies (20 dummies for 1992-2011 years) are used in order to take into account the industry-specific and year-specific characteristics.

The descriptive statistics of the above discussed variables are represented in Table 1 where mean, median and standard deviations are reported.

Table 1. Summary statistics

Variable	Mean	Median	Standard deviation
Board size:			
mboard	3.37	3.00	2.10
sboard	3.38	3.00	1.95
Dependent variable:			
roa	0.01	0.02	0.46
Control variables:			
ta	10,800,000	697,040.5	93,400,000
sales	5,113,544	511,287	36,800,000
leverage	0.44	0.40	0.30

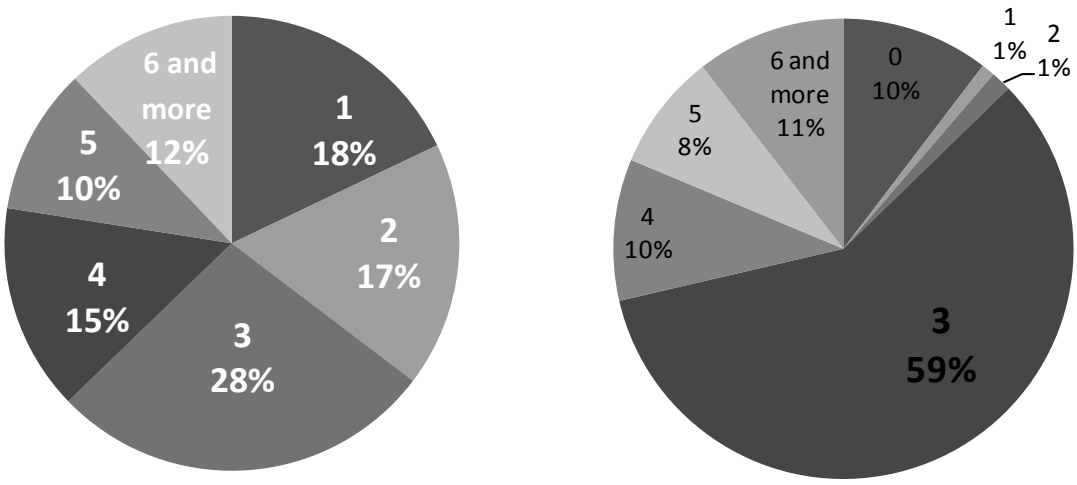
The median size of the Management Board in the sample is the same as median size of the Supervisory Board and is equal to three. Comparing board sizes with those of Dutch firms (Hans van Ees et al, 2003), Management Board has the same median size in both countries; however, the Hungarian Supervisory Boards tend to be much smaller (Hans van Ees et al reported the median size of 5 members). Summing up the median number of members of two boards for Hungarian firms and comparing it with board size for US firms (Yermack (1996) reported the median board size of 12 members), Hungarian boards are twice as small as their US counterparts.

Figure 1 shows the breakdowns of firm-year observations by number of members in Management Board and Supervisory Board respectively. The Management Board consists of from one to three members in more than half of firm-year observations, whereas the Supervisory Board has 3 members in 59% of firm-year observations. Thus, it can be assumed that Hungarian companies have a tendency to have small boards. Furthermore, 28% and 39% of companies in the sample did not change the size of Management Board and Supervisory Board respectively over the observed period. 4719 out of 6520 companies (72%) had changes

in their Management Board size, whereas 3948 out of 6520 companies (61%) had changes in their Supervisory Board size over the observed period.

Figure 1. A breakdown of firm-year observations by number of members in:

a) Management Board **b) Supervisory Board**



The median company in the sample has sales of HUF 511.3 million and total assets of HUF 697 million. The median ROA of 2% and the mean ROA of 1% demonstrate that Hungarian joint-stock companies have low profitability. The median number of employees is 46, while the mean value is 257 people. The median total debt is 40% of total assets. Around 55% of firms of the sample operate in following seven out of 57 industries: real estate, wholesale, agriculture and hunting, food and beverage production, construction, financial activities and other business activities.

4. Main regression results

The following chapter provides the description of estimated equations, methods (OLS and fixed-effects models) and the key regression results. Hence, for the purpose of investigating the research question about the relationship between board size and firm performance in Hungary, I run several regressions with linear and dummy specification of board size using OLS and FE models. Then the findings are checked for robustness, using different specifications of dependent and independent variables.

4.1 Effect of board size on ROA: linear specification of board size

Based on the discussion of the responding variable (ROA) and explanatory variables in the previous chapter, the following equations are estimated:

$$ROA = \beta_0 + \beta_1 * log(mboard) + \beta_2 * leverage + \beta_3 * \log(ta) +$$

$$+ \sum \gamma_i * Industry\ dummies + \sum \delta_i * Year\ dummies + e \quad (2)$$

$$ROA = \beta_0 + \beta_1 * \log(sboard) + \beta_2 * leverage + \beta_3 * \log(ta) +$$

$$\sum \gamma_i * Industry\ dummies + \sum \delta_i * Year\ dummies + e \quad (3)$$

To evaluate the effect of size of the Management Board on firm performance, equation (2) should be regressed. Analogously, the equation (3) serves to estimate the effect of size of the Supervisory Board on firm performance.[18]

Similar to Yermack (1996), I use the ordinary least squares (OLS) method for estimation as well as fixed-effects (FE) model. The OLS method is easy to use; however, the results can be biased due to endogeneity. The FE method partially mitigates the endogeneity

[18] I use log(mboard) and log(sboard) in order to have the effects in proportions.

problem through controlling for unobservable firm-specific characteristics that do not change over the time and may affect both return on assets and board size. Nevertheless, it should be taken into account that most of the variation in size of boards arises in the cross section, not in the time series. The correlation between size of Management Board (Supervisory Board) and its lagged value is 0.87 (0.91) in the sample. Moreover, the size of boards did not change over time for almost a quarter of the firms in the sample used in this thesis. Thus, fixed effects estimators may not detect an effect of board size on firm performance even if one exists.

The results of OLS and FE regressions of equations (2) and (3) with White robust standard errors for OLS and clustered standard errors for FE are presented in Tables 2 and 3, respectively.

Table 2. OLS and FE regression results: size of Management Board and ROA

Dependent variable: *ROA*		
Variable	**OLS**	**Fixed-effects**
Log of size of Management Board	-0.017**	-0.015**
	(0.003)	(0.004)
Log of Total assets	0.027**	0.112**
	(0.003)	(0.021)
Leverage	-0.209**	-0.320**
	(0.013)	(0.025)
Year dummies	Yes	Yes
Industry dummies	Yes	No
Sample size	40536	40536
R-squared	0.029	0.039

** statistically significant at 1% level

Table 2 illustrates the statistically significant negative relationship between size of the Management Board and ROA in both models. Looking at the OLS coefficients, when board size doubles, ROA is expected to decrease by 0.0118, holding other variables fixed. If board size increases by 50%, ROA falls by about 0.0069, holding other variables fixed. The expected *ceteris paribus* difference in ROA, when three-member board increases by one person, is -0.0049. The result is economically significant. Since mean value of ROA is 0.01,

the above mentioned increase in number of board members may lead to the decrease of ROA by half. Taking into consideration that the mean value of total assets is HUF 10,800.00 million and assuming that it does not change, if ROA changes by -0.0049, the pretax profit will decrease by HUF 52.92 million.

The results of FE model are also significant and show almost the same impact of Management Board size on ROA, for example: when board size doubles, ROA is expected to decrease by 0.0104 *ceteris paribus.*

Table 3. OLS and FE regression results: size of supervisory board and ROA

Dependent variable: *ROA*		
Variable	**OLS**	**FE**
Log of size of Supervisory Board	-0.047** (0.005)	-0.018* (0.008)
Log of Total assets	0.026** (0.002)	0.106** (0.022)
Leverage	-0.207** (0.013)	-0.314** (0.024)
Year dummies	Yes	Yes
Industry dummies	Yes	No
Sample size	40536	40536
R-squared	0.030	0.036

** statistically significant at 1% level
* statistically significant at 5% level

Table 3 provides negative coefficients of Log of size of Supervisory Board in both OLS and FE models which serves as an empirical evidence of negative impact of size of the Supervisory Board on ROA. OLS estimator of Log of size of Supervisory Board shows that if a company doubles its board size, ROA will decrease by 0.0326 *ceteris paribus*. When the Supervisory Board is extended by 50%, ROA is predicted to fall by 0.0191, holding other variables fixed. If the number of members of the supervisory board increases from three to four, the expected effect on ROA is 0.0135. As in the case of Management Board, the changes in ROA are economically significant.

The FE coefficient of Log of size of Supervisory Board is significant, but 2.6 times less than OLS one. Thus, when a company doubles its board size, ROA is expected to decrease by 0.0125 *ceteris paribus*. This difference between OLS and FE results can be explained by small variation of size of Supervisory Board within a firm, hence, FE estimators may not detect the sought effect.

Moreover, the adverse impact of hiring an additional director to Supervisory Board is much stronger than to the Management Board according to OLS estimators. This finding may imply more inefficiencies in Hungarian Supervisory Boards. In other words, costs of having an additional director in Supervisory Board significantly overwhelm benefits from his/her contribution to a company. The results partially support findings of Hans van Ees et al. (2003) with respect to the Netherlands.

The signs of estimated coefficients of control variables are in line with the expectations. In all models the firm size, proxied by log of total assets, has a positive association with financial firm performance, whereas leverage negatively affects ROA. It can be explained by the fact that large companies have many resources to generate big profit which increases ROA. Higher leverage indicates higher share of borrowings has been used to fund business processes that leads to higher interest payables which decline pretax profit and, consequently, ROA.

4.2 Effect of board size on ROA: dummy specification of board sizes

For further investigation of the relationship between board size and firm performance among Hungarian joint-stock companies, I created dummy variables for each size level of boards. In other words, *m1-m10* are dummies for size of the Management Board, where *m1* is equal to one if a company has only one director in a specific year, *m2* is equal to one if a

company has two directors in a specific year and so on. The same logic was behind creating dummy variables (*s0-s10*) for size level of the Supervisory Board.

Table 4. OLS regression results: ROA and dummies of Management Board size

Dependent variable: ROA		
Variable	**OLS**	**FE**
m1	0.068** (0.019)	0.065* (0.030)
m2	0.078** (0.019)	0.034* (0.029)
m3	0.069** (0.019)	0.059 (0.031)
m4	0.048* (0.019)	0.044 (0.029)
m5	0.050** (0.018)	0.045 (0.028)
m6	0.038* (0.18)	0.038 (0.029)
m7	0.039* (0.018)	0.028 (0.028)
m8	0.043* (0.020)	0.044 (0.028)
m9	0.038 (0.020)	0.042 (0.026)
m10	0.036 (0.020)	0.019 (0.027)
leverage	-0.210** (0.013)	-0.320** (0.025)
ta_log	0.027** (0.003)	0.112** (0.021)
const	-0.372** (0.039)	-1.340** (0.271)
Year dummies	Yes	Yes
Industry dummies	Yes	No
Sample size	40536	40536
R-squared	0.029	0.039

** statistically significant at 1% level
* statistically significant at 5% level
Benchmark is size of the Management Board that is greater than 10 members.

Controlling for the same variables as previously, I estimated the equations (2) and (3) where the variable *log(mboard)* (*log(sboard)*) was substituted by dummy variables *m1-m10* (*s0-s10*). In the regression with *m1-m10* the benchmark is firm-year observations with size of the Management Board that is greater than 10 members. In the regression for Supervisory Board the reference group is the firm-year observations with size of Supervisory Board greater than eight. Tables 4 and 5 give the estimation results.

Based on the regression results represented in Table 4, I plotted Figure 2 where size of the Management Board is along the x-axis and regression coefficients of dummies of board size are along the y-axis.

Figure 2. Relative impact of size of the management board on ROA

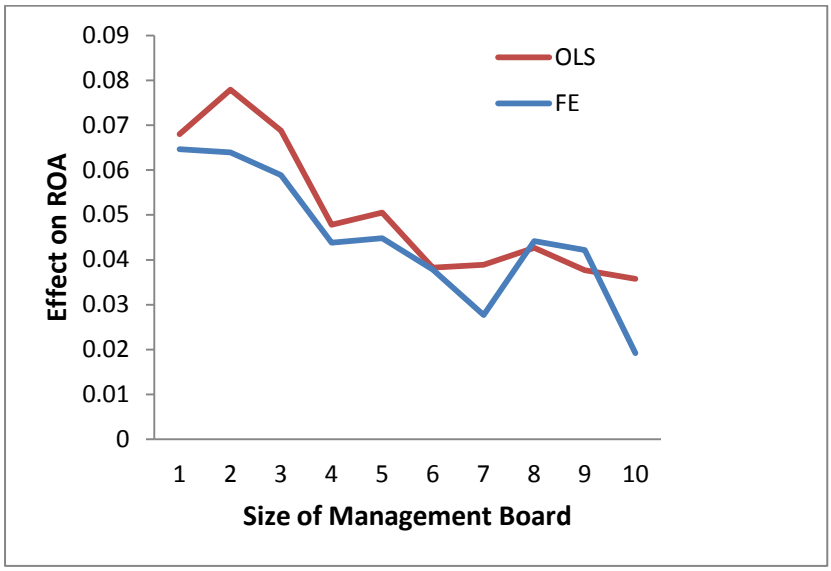


Figure 2 illustrates the relative impact of size of the Management Board on ROA compared to the impact of boards that consist of more than 10 members. Note that the positive effect of board size on ROA declines almost monotonically over the range of size of the Management Board. For companies with small Management Boards (from one to three members) the positive impact of boards on ROA is greater than for companies with four and more directors. Consequently, the bigger the Management Board is, the lower ROA is.

Table 5. OLS regression results: ROA and dummies of Supervisory Board size

Dependent variable: ROA		
Variable	**OLS**	**FE**
s0	0.086**	0.015
	(0.013)	(0.019)
s1	0.074**	0.040
	(0.018)	(0.022)
s2	0.061**	-0.001
	(0.013)	(0.017)
s3	0.079**	0.031*
	(0.010)	(0.013)
s4	0.044**	0.016
	(0.010)	(0.013)
s5	0.037**	0.024
	(0.009)	(0.013)
s6	0.036**	0.014
	(0.009)	(0.010)
s7	0.035**	0.011
	(0.010)	(0.012)
s8	0.022*	0.012
	(0.009)	(0.010)
leverage	-0.212**	-0.320**
	(0.013)	(0.025)
ta_log	0.029**	0.111**
	(0.003)	(0.021)
const	-0.404**	-1.301**
	(0.038)	(0.269)
Year dummies	Yes	Yes
Industry dummies	Yes	No
Sample size	40536	40536
R-squared	0.030	0.039

** statistically significant at 1% level
* statistically significant at 5% level
Benchmark is size of the Supervisory Board that is greater than 8 members.

Analogously to the previous case, using data from Table 5, I plotted Figure 3 with size of the Supervisory Board on the x-axis and regression coefficients of board size dummies on the y-axis. It is worth noting that most of FE estimates are insignificant. It can be that FE method does not detect the effect due to small variation of Supervisory Board size within a firm.

Figure 3. Relative impact of size of the Supervisory Board on ROA

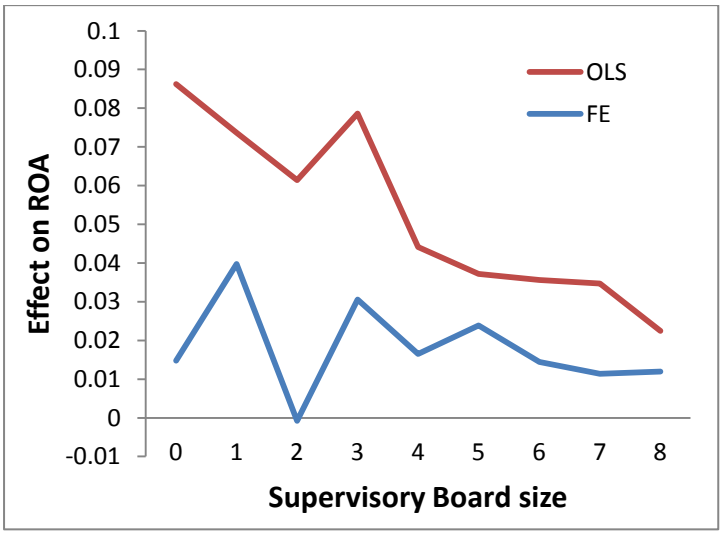


Figure 3 (OLS line) shows that the relative positive impact of size of the Supervisory Board on ROA (comparing to the effect of boards that consist of more than 10 members) declines with an increase in board size. It seems that when the Supervisory Board is bigger than three, costs of a large board overweigh the benefits from the expert advice.

Thus, Figures 2 and 3 provide a graphical representation of empirical support for the negative relationship between board size (of either Management Board or Supervisory Board) and firm performance.

4.3 Robustness check

A key problem in studying the relationship between board size and firm performance is that variables of interests are endogenous (Hermalin and Waisbach, 2003). For example, firm performance (ROA) is a result of boards' actions and characteristics (board size). Meanwhile, the current composition and size of boards may be affected by current financial performance. In order to mitigate the endogeneity problem and check the robustness of my result, I ran several regressions with different financial ratios, lagged values of ROA and

another proxy for firm size.[19] The section does not provide the tables with results here, rather it provides the impact of changes in specifications on the sign and significance of coefficients of *mboard* and *sboard* variables. The tables with results can be found in Appendix B.

Board size and other financial ratios

Since both ROA and board size could be endogenous, I used other accounting measures as proxies for firm performance to check how it will change my results from the previous section. Other candidates for a dependent variable are return on equity (ROE), return on sales (ROS) and ratio of pretax profit over employment. Using OLS and FE models, I regressed them against Log of size of Management Board (Log of size of Supervisory Board) and control variables: log of total assets, leverage, year dummies and industry dummies (in case of OLS model). In all specifications the sign of coefficients of variables in the interest was negative. However, there was no significant association between board size and firm performance, except for the OLS models with the ratio of pretax profit over employment as a dependent variable, where the coefficients for Log of size of Management Board and Log of size of Supervisory Board are significant and negative.

Lagged values of ROA

Following Coles et al. (2008), I used another approach to address endogeneity, re-estimating the OLS and fixed-effects models of Tables 2 and 3 with lagged values of ROA as the dependent variable. As a result, the key coefficients were still negative and significant, except for an estimated coefficient for Log of size of Supervisory Board in the FE model which had a negative sign, but was statistically insignificant.

[19] As it was mentioned above, the FE method partially mitigates the endogeneity problem through controlling for unobservable firm-specific characteristics that do not change over the time and may affect both return on assets and board size. Nevertheless, since most of the variation in size of boards arises in the cross section, not in the time series, fixed effects estimators may not detect an effect of board size on firm performance even if one exists.

Firm size

Since firm performance (ROA), size of boards and firm size can be correlated in complicated ways, following Yermack (1996), I did the robustness check of my results using log of sales as a proxy for company size. Thus, I ran the same regressions as in Tables 2 and 3, but with log of sales instead of log of total assets. The results for the OLS model were similar to those reported in Tables 2 and 3. In the case of the FE model, the coefficients for Log of size of Management Board and Log of size of Supervisory Board were negative and statistically significant at 10 % and 6% significance level respectively.

5. Supplementary regression results

The chapter presents the results of investigation whether firms make difference between the two boards and whether the negative relationship between board size and firm performance depends on complexity of a company.

5.1 Do firms make a difference between the two boards?

The results that are found in the previous chapter suggest that an increase in the size of the Management Board has an adverse impact on firm performance. The size of the Supervisory Board is also negatively correlated with firm's financial performance. The question, however, is whether the firms are following the division into two boards solely to comply with the requirements of the Company Law or they in fact consider the two boards as separate and fully functional.

In order to verify that a Management Board cannot substitute a Supervisory Board and *vice versa*, I ran a regression where size of Supervisory Board is a dependent variable, whereas size of Management Board is independent one. I also controlled for the same variables as previously: log of total assets, leverage, industry dummies and year dummies. If firms consider Management Board and Supervisory Board as one management body (Board of Directors), then the coefficient for size of Management Board should be negative.

Based on the results of the regression in Table 6, the hypothesis about neglecting the two-tier corporate governance system can be rejected, since the OLS and FE coefficients for size of Management Board are positive, which means that boards cannot substitute each other. Holding other variables fixed, if the size of the Management Board increases by 5 members, the Supervisory Board is expected to increase by 1 more director, based on OLS estimates.

The results are significant and reasonable. The larger the Management Board is, the more supervision is required by the Supervisory Board.

Table 6. Does the two-tier structure matter?

Dependent variable: Size of Supervisory Board		
Variable	**OLS**	**FE**
Size of Management Board	0.214** (0.007)	0.121** (0.016)
Log of Total assets	0.279** (0.006)	0.144** (0.020)
Leverage	-0.344** (0.027)	0.065 (0.059)
Year dummies	Yes	Yes
Industry dummies	Yes	No
Sample size	40536	40536
R-squared	0.347	0.099

** statistically significant at 1% level

Furthermore, I estimated the equation (2), additionally controlling for the size of Supervisory Board:

$$ROA = \beta_0 + \beta_1 * log(mboard) + \beta_2 * log(sboard) + \beta_3 * leverage + \beta_4 * \log(ta) +$$

$$+ \sum \gamma_i * Industry\ dummies + \sum \delta_i * Year\ dummies + e \qquad (4)$$

As presented in Table 7, the coefficients β_1 and β_2 are similar to those from Tables 2 and 3. Thus, the OLS coefficient for Log of size of Management Board (β_1) is -0.011 versus -0.017 from Table 2, whereas the OLS coefficient for Log of size of Supervisory Board (β_1) is -0.043 versus -0.047 from Table 3. The results, which are statistically significant at the 1% significance level, confirm that size of any of these boards is negatively correlated with firm financial performance independently from each other.

Table 7. OLS regression results: Size of Management Board and size of Supervisory Board are in one equation

Dependent variable: ROA Variable	OLS	FE
Log of Size of Management Board	-0.011** (0.003)	-0.016** (0.004)
Log of Size of Supervisory Board	-0.043** (0.005)	-0.014* (0.008)
Log of Total assets	0.027** (0.002)	0.107** (0.022)
Leverage	-0.208** (0.013)	-0.315** (0.024)
Year dummies	Yes	Yes
Industry dummies	Yes	No
Sample size	40536	40536
R-squared	0.030	0.036

** statistically significant at 1% level
* statistically significant at 6% level

5.2. Complexity vs simplicity or Does the size of the firm matter?

Coles et al (2008) found that there is a negative relationship between board size and firm performance for simple US firms. Nevertheless, this relationship is positive for complex companies that are large, leveraged and diversified. They explained the difference in results with an argument that CEOs of complex companies may need more advice; consequently, they require larger boards. The next step of the research was to check whether the size of firm has an effect on the above mentioned relationship in Hungary. For this purpose the whole sample of Hungarian joint-stock companies was divided into two equal sample-sized samples: 1) 20,268 firms, whose total assets are less than HUF 697,040,500 (a median of total assets of initial sample, - simple firms; 2) 20,268 firms, whose total assets are greater than HUF 697,040,500, - complex firms.

Estimating equations (2) and (3) for each of these samples separately and using OLS and FE models, I received the following results presented in Table 8.

Table 8. Complexity versus simplicity

Dependent variable: ROA				
Variable	**Management Board**		**Supervisory Board**	
	Simple	**Complex**	**Simple**	**Complex**
OLS method				
Log of size of Management Board	-0.025** (0.006)	-0.004** (0.002)		
Log of size of Supervisory Board			-0.056** (0.013)	-0.015** (0.003)
Log of Total assets	0.080** (0.009)	0.003** (0.001)	0.075** (0.008)	0.005** (0.001)
Leverage	-0.269** (0.022)	-0.199** (0.022)	-0.267** (0.023)	-0.119** (0.007)
Year dummies	Yes	Yes	Yes	Yes
Industry dummies	Yes	Yes	Yes	Yes
Sample size	20268	20268	20268	20268
R-squared	0.038	0.078	0.037	0.088
FE method				
Log of size of Management Board	-0.013 (0.009)	-0.006* (0.003)		
Log of size of Supervisory Board			-0.022 (0.018)	-0.001 (0.006)
Log of Total assets	0.155** (0.023)	0.039** (0.008)	0.155** (0.016)	0.040** (0.009)
Leverage	0.399** (0.037)	-0.199** (0.022)	-0.381** (0.035)	-0.199** (0.022)
Year dummies	Yes	Yes	Yes	Yes
Industry dummies	No	No	No	No
Sample size	20268	20268	20268	20268
R-squared	0.046	0.049	0.043	0.053

** statistically significant at 1% level
* statistically significant at 5% level

The results show that size of boards is negatively correlated with ROA in spite of the complexity of a company *ceteris paribus*, since OLS and FE coefficients of Log of Size of Management Board and Log of Size of Supervisory Board are negative. OLS estimates are statistically significant at 1% significance level, whereas FE estimate are mostly insignificant, which can be explained by the fact that most of variation in Supervisory Board size arises in the cross section; consequently, FE might not be able to detect the effect.

These OLS results for Hungarian companies significantly diverge from the findings of Coles et al. (2008); nevertheless, the adverse impact is smaller in absolute terms for complex firms. Consequently, I can suggest that the difference between costs and benefits from an additional member in any board is smaller for complex firms, compared to simple firms,

where costs of an additional director significantly overwhelm benefits from him/her. As in case of investigation of the whole sample (Tables 2 and 3), the negative impact of the Supervisory Board size is bigger than the one of Management Board size for both complex and simple firms, which implies a higher level of inefficiency in Hungarian Supervisory boards compared to Management Boards.

6. Conclusions

This thesis has evaluated the relationship between board size and firm performance among Hungarian joint-stock companies over the period 1992-2011. Empirical and theoretical literature contains a discussion about advantages and disadvantages of having large boards. The main advantage of having many board members is that they can give constructive and valuable expert advice, however, having large boards can be ineffective due to arising free-rider problem, longer decision-making process and significant financial burden driven by large directors' salaries.

The research question was whether size of the board affects firm performance positively or negatively in Hungary. In other words, do costs of a large board overweigh the benefits?

Using OLS and FE models with data from 1992-2011 for 6520 Hungarian joint-stock companies, I found a negative relationship between size of the Management Board and firm financial performance proxied by return on assets (ROA). For instance, according to OLS model, when the board size increases by one person from three to four members, ROA is expected to decrease by 0.0049 *ceteris paribus*.

Obtained empirical results also provided evidence of a negative impact of the size of Supervisory Board on firm performance. OLS estimators showed that if the number of members of the Supervisory Board increases from three to four, the expected adverse effect on ROA is 0.0135, holding other variables fixed. Furthermore, an increase of size of Supervisory Board has more adverse impact on ROA, than that of Management Board, suggesting that Supervisory Boards are more inefficient and costs of a large Supervisory Board overweigh the benefits.

The main results proved robust to dummy specification of board sizes, lagged values of ROA and an alternative control for firm size.

I also found that Hungarian companies consider Management Board and Supervisory Board as separate and fully functional organs; one board cannot substitute the other one. Moreover, the empirical results showed that the negative impact of board size is negligible for complex firms, suggesting that the difference between costs and benefits of having large board for large firms with high advising requirements are almost equal.

The results of this thesis brought a significant added value to the literature, providing evidence of negative relationship between board size and firm performance in Hungarian joint-stock companies.

The policy implication of the results largely depends on their interpretation. Hermalin and Weisbach (2003) elaborated an important concept of equilibrium and out-of-equilibrium explanation of the results. According to this concept, if we assume that companies do not have an optimal board size, i.e., they are not in the equilibrium, then an upper limit on board size established by government may lead to the prosperity of companies, especially for small ones. In contrast, if companies are on the equilibrium path now, i.e., they already have an optimal number of board members, then interpretation implies that some other factors affect both board size and firm performance; consequently, upper limit on board size, which encourages having small boards may hurt companies. Thus, the question of optimal size of boards, whether or not the size of the boards is in equilibrium, as well as interpretation of these results is a good topic for future research.

Appendix A

Table 9. List of industries

Two-digit ISIC REV.3.1, NACE 1.1, TEAOR'03 industries	Description	Frequency	% of total
01	Agriculture, hunting	3263	8.05
02	Forestry	387	0.95
05	Fishery	73	0.18
10	Coal mining	16	0.04
11	Petroleum and natural gas production and related services	24	0.06
12	Mining of uranium and thorium ores	9	0.02
13	Metal ore mining	12	0.03
14	Other mining	47	0.12
15	Food and beverage production	2484	6.13
16	Manufacture of tobacco products	25	0.06
17	Textile manufacture	324	0.80
18	Manufacture of wearing apparel; dressing, dyeing, peltry	399	0.98
19	Leather processing; manufacture of handbags, strapping, footwear	114	0.28
20	Processing wood, straw and plaiting materials	182	0.45
21	Paper and paper production	268	0.66
22	Publishing and printing	749	1.85
23	Coke production, petroleum products and nuclear fuel production	17	0.04
24	Manufacture of chemical products	719	1.77
25	Manufacture of rubber and plastic products	347	0.86
26	Production of non-metallic mineral products	407	1.00
27	Metal production as a factor	205	0.51
28	Producing metal processing products	729	1.80
29	Machinery and equipment production	784	1.93
30	Computer production	77	0.19
31	Other electric device production	275	0.68
32	Communication engineering products, and apparatus production	304	0.75
33	Precision manufacturing	273	0.67
34	Production of a road vehicle	168	0.41
35	Other vehicles manufactured	81	0.20
36	Furniture factories; other manufacturing	325	0.80
37	Raw material recycling	24	0.06
40	Electrical energy, gas, steam and hot water supply	676	1.67
41	Water extraction, maintenance, distribution	431	1.06
45	Construction	2098	5.18

Table 9. List of industries (continued)

Two-digit ISIC REV.3.1, NACE 1.1, TEAOR'03 industries	Description	Frequency	% of total
50	Vehicle trade , repair, fuel retail	555	1.37
51	Wholesale	3583	8.84
52	Retail	1889	4.66
55	Accommodation, hotel services	923	2.28
60	Transportation via inland pipelines	790	1.95
61	Water transportation	32	0.08
62	Air transportation	41	0.10
63	Supporting activities for transportation, travel agencies	603	1.49
64	Post and telecommunications	445	1.10
65	Financial activities	2872	7.09
66	Insurance and pension funding	408	1.01
67	Activities auxiliary to financial services	915	2.26
70	Real estate	3265	8.05
71	Rentals	212	0.52
72	Computer science activities	1144	2.82
73	Research and development	335	0.83
74	Other business activities	4793	11.82
75	Public administration and defense; compulsory social security	2	0.00
80	Education	169	0.42
85	Health and social work	166	0.41
90	Sewage and waste handling	347	0.86
92	Entertainment, culture, sport	519	1.28
93	Other services	212	0.52
Total		40536	100.00

Appendix B

Table 10. Robustness check: Board size and ROE

Dependent variable: ROE				
Variable	**OLS**	**FE**	**OLS**	**FE**
Log of Size of Management Board	-0.062 (0.106)	0.071 (0.182)		
Log of Size of Supervisory Board			0.023 (0.191)	0.269 (0.390)
Log of Total assets	0.003 (0.048)	0.193 (0.138)	-0.011 (0.049)	0.101 (0.145)
Leverage	-0.085 (0.564)	0.176 (0.287)	0.248 (0.301)	0.177 (0.307)
Year dummies	Yes	Yes	Yes	Yes
Industry dummies	Yes	No	Yes	No
Sample size	40507	40507	40507	40507
R-squared	0.002	0.001	0.003	0.001

Table 11. Robustness check: Board size and ROS

Dependent variable: ROS				
Variable	**OLS**	**FE**	**OLS**	**FE**
Log of Size of Management Board	-1.057 (1.361)	0.071 (0.182)		
Log of Size of Supervisory Board			1.661 (1.807)	0.269 (0.390)
Log of Total assets	0.990* (0.394)	0.193 (0.138)	1.038* (0.424)	0.101 (0.145)
Leverage	-1.820 (3.025)	0.176 (0.287)	2.826 (2.677)	0.177 (0.307)
Year dummies	Yes	Yes	Yes	Yes
Industry dummies	Yes	No	Yes	No
Sample size	40536	40536	40536	40536
R-squared	0.004	0.001	0.007	0.001

* statistically significant at 5% level

Table 12. Robustness check: Board size and Pretax profit over Employment

Dependent variable: Pretax profit over Employment				
Variable	**OLS**	**FE**	**OLS**	**FE**
Log of Size of Management Board	-3920.023** (1358.289)	130.916 (1278.868)		
Log of Size of Supervisory Board			-4235.10** (1532.314)	1664.487 (1515.822)
Log of Total assets	4457.454** (1346.369)	5443.599** (1685.762)	2455.45** (374.264)	4746.408** (1727.887)
Leverage	-20840.97** (5835.698)	-17335.1** (3870.408)	-11561.78** (1706.044)	-16633.72** (3481.338)
Year dummies	Yes	Yes	Yes	Yes
Industry dummies	Yes	No	Yes	No
Sample size	40536	40536	40536	40536
R-squared	0.006	0.002	0.008	0.004

** statistically significant at 1% level

Table 13. Robustness check: Lagged values of ROA

Dependent variable: Lagged values of ROA				
Variable	**OLS**	**FE**	**OLS**	**FE**
Log of Size of Management Board	-0.008** (0.002)	-0.007* (0.003)		
Log of Size of Supervisory Board			-0.022** (0.004)	-0.003 (0.005)
Log of Total assets	0.011** (0.001)	0.042** (0.006)	0.013** (0.001)	0.048** (0.005)
Leverage	-0.124** (0.007)	-0.154** (0.015)	-0.127** (0.007)	-0.151** (0.014)
Year dummies	Yes	Yes	Yes	Yes
Industry dummies	Yes	No	Yes	No
Sample size	31968	31968	31968	31968
R-squared	0.037	0.021	0.048	0.029

** statistically significant at 1% level
* statistically significant at 5% level

Table 14. Robustness check: Firm size

Dependent variable: ROA				
Variable	**OLS**	**FE**	**OLS**	**FE**
Log of Size of Management Board	-0.020** (0.004)	-0.008 (0.005)		
Log of Size of Supervisory Board			-0.052** (0.004)	-0.013 (0.007)
Log of Sales	0.030** (0.002)	0.037** (0.005)	0.031** (0.002)	0.040** (0.005)
Leverage	-0.224** (0.014)	-0.298** (0.022)	-0.221** (0.013)	-0.296** (0.020)
Year dummies	Yes	Yes	Yes	Yes
Industry dummies	Yes	No	Yes	No
Sample size	40536	40536	40536	40536
R-squared	0.035	0.023	0.038	0.024

** statistically significant at 1% level

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