Higher firm value with a smaller board of directors

The effect of board size on firm value in the oil sector in the US

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Abstract

This thesis evaluates the relationship between board size and firm value. I use Tobin's Q as a proxy for firm value, and I find an inverse association between board size and firm value for a sample of 213 firms in the US between 2010 and 2017. These findings indicate that smaller boards are more effective in monitoring management. The results are robust to numerous controls such as firm size, board composition, and growth opportunities. I do not find any significant association between board size and other firm characteristics such as ROA, ROS, sales over assets, CEO turnover and CEO compensation.

Keywords: Corporate Governance, Board of Directors, Firm Value

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1 Introduction

Over the past couple decades, a lot of research has been done concerning the flaws of corporate governance. Berle and Means (1932) described the difficulties that we are still facing this time today. They argued that there is a clear separation between management and shareholders. Shareholders did not have a lot to say, and management were only in theory accountable towards the board of directors. After their research, numerous studies have been conducted that tried to explain the deficiencies of corporate governance. Various reasons are given, such as takeover threats or executive compensation. However, the failures of the board of directors are according to Lipton and Lorsch (1992), the reason why the system isn't working the way it should. The board should be able to guide and advise companies when facing difficulties. If they don't companies might lose shareholders value, employees and their competitive position (Lipton & Lorsch, 1992).

The board of directors is in potential a very powerful corporate governance mechanism. The board has the power to monitor and control the performance of managers, and if needed condemn the performance of top executives (Fama & Jensen, 1983). However, the board is vulnerable to many flaws that might reduce their effectiveness. Board composition is of great influence on whether the board will be able to monitor management correctly. For example, the CEO of a company often fulfils the function of chairman of the board simultaneously. Jensen (1993) states that without an independent leader the board will not be able to monitor executives the way it should. Another issue is board culture, where politeness can prevail in boardrooms (Jensen, 1993).

Still, not much literature can be found which examines board size to improve the functioning of the board of directors. Even though group size, to enhance group performance, is an association which can be found in several studies. Lipton and Lorsch (1992) state that when boards get beyond seven or eight, the decision-making process becomes less effective. Not all board members will have the chance to discuss their ideas and opinions due to the limited time available. This leads to less outspoken discussions in board rooms about e.g. CEO performance (Lipton & Lorsch, 1992). This is one of the ways how the CEO can regulate larger boards in their advantage. However, a relatively larger board brings more human capital which leads to meaningful advice for management (De Andres & Vallelado, 2008). In addition, larger boards can also improve the supervision of executives. Thus, a trade-off can be seen between the advantages and disadvantages of reducing board size.

In this thesis, a research will be conducted on how board size relates to firm value in the US oil sector. Yermack (1996) already presented evidence on this topic, and found an inverse association between board size and firm value. These findings suggest that small boards operate more effectively, which positively influences firm value. My thesis is inspired by the paper of Yermack (1996) and the aim is to provide an addition to current literature on this topic. I will conduct a research with more recent data and

solely focused on the oil sector. The focus on the oil sector is an extension to current literature, and so with my thesis I will be filling this empirical gap.

The oil and gas industry play an important role in the global economy. Without proper governance in this sector, companies might face several external and internal difficulties. The attraction of investments might become difficult without the proper control and monitoring by the board of directors. In addition, oil companies also have a social responsibility such as sustainability. Without an effective board, inefficiencies might occur which could have great social consequences. As mentioned, the board of directors is a powerful corporate governance mechanism. Reducing board size might increase firm value and simultaneously the monitoring abilities of the board. This could be of great significance to major oil companies, when considering their social responsibility, which might lead them to restructuring their board of directors.

To reach an answer on how board size influences firm value in the US oil sector the following research question is constructed: 'To what extent is firm value dependent on the size of the board of directors in the US oil sector between 2010 and 2017?'

The remainder of this thesis proceeds as follows. In Section 2 the relevant literature will be discussed, and based on the literature review four hypotheses are constructed which will support my main research question. In Section 3 the data sources are described, variable definitions are given, and descriptive statistics are presented. Section 4 will discuss the methodology, followed by Section 5 which will present the empirical results. Section 6 concludes.

2 Literature Review and Hypotheses

In this section a literature review is conducted on the studies that contributed to the research of Yermack (1996). In addition, concepts that are relevant and crucial to understand the association between board size and firm value are defined and elaborated. Ultimately, based on the literature four hypotheses will be constructed.

2.1 The Oil and Gas Industry

Around 1970, the oil industry was dominated by European and American companies, called the 'Seven Sisters'. These 'Seven Sisters' consist out of the seven following companies: Exxon, Chevron, Texaco, Gulf Oil, Mobil, British Petroleum, and Royal Dutch/Shell Group. The successes of these 'Seven Sisters' were starting to get challenged when OPEC emerged in the 1960s. OPEC is an intergovernmental organisation of 15 oil-exporting developing nations that coordinates oil and gas policies of its member countries ("Our Mission", 2018). After OPEC, there was an emergence of state-owned oil companies which changed the industry drastically. This resulted in the nationalization of some major oil companies which lead to some small national producers entering the market (Gately and Griffin, 1986).

After the 1970s, where increased competition reshaped the market, low oil prices became the most significant development during the 1980s. Profits were directly connected to the value of crude oil, which meant that major oil companies were heavily affected by the declining prices. Especially the price drop during 1986 is a very significant event throughout this decade. For the oil companies to survive, employment began to reduce drastically (Gately and Griffin, 1986).

After the 1980s, competitive advantages were sought out by many companies in the oil sector. An evolution occurred from vertically-integrated and centralized organizations into decentralized enterprises. These changes were influenced by the 1980s which had a great impact on the economy and society as a whole. Oil companies were now solely engaged in creating shareholder value and improving efficiency (Gately and Griffin, 1986).

The 2000s were very profitable for the oil industry. Oil prices rose dramatically and some other interesting developments occurred. A new emergence of state-owned oil companies was dominating the world oil and gas sector. They were referred to as the 'New Seven Sisters'. This group consists out of the following oil companies: Saudi Aramco, Venezuela's Pdvsa, Russia's Gazprom, China National Petroleum Company, the National Iranian Oil company, Brazil's Petrobras, and Malaysia's Petronas (Hoyos, 2007).

However, over the last decade the oil and gas industry has suffered a strong decline in its market value. This is predominantly caused by the sharp decline in the price of crude oil (Marketline Industry Profile, 2018). In addition, volume consumptions have declined in Europe as there have been improvements

in efficient technology which has reduced demand for energy intensive machinery. However, natural gas has gained demand across countries in the Asia-Pacific region. This will lead to a growth in the market value of the oil and gas sector in the upcoming years. The European oil and gas sector should also see a return in growth as oil prices will stabilize due to for example the OPEC supply cuts (Marketline Industry Profile, 2018).

2.2 Theories

The term corporate governance can be described in multiple ways. Monks and Minow (1995) define corporate governance as a relationship between all stakeholders, during the process of determining the strategy of the company. A similar definition is given by Cochran and Wartick (1988). They argue that corporate governance is an overarching term for all theories, concepts and actions of directors and her supervision, which relate to the relationship between the company, its shareholders and stakeholders.

Although corporate governance can be described in multiple ways, it is generally assumed that it expresses the relation between directors, shareholders and other stakeholders, where the focus is on the differences between these parties. Even though directors, shareholders and other stakeholders like to do business with each other, in practice it often turns out to be difficult to align their underlying interests. These underlying interests are the basis of the two known theories behind corporate governance.

2.2.1 Agency theory

The agency theory is a concept which describes the relationship between principals and agents. This relationship means that one or more persons (the principal) incites another person (the agent) to perform tasks in the interest of the principal, where some responsibility for making his own choices is given to the agent (Jensen & Meckling, 1976).

If both the principal and the agent want to maximize their own usefulness, it can be assumed that the agent will not always act accordingly to the principal's interests. The principal has several ways to ensure that the agent acts amongst his interests as much as possible. However, even with all these measures, the maximum prosperity of the principal will never be fully achieved, given the nature of the relationship. The total costs the principal must incur to be able to monitor and motivate the agent, and the loss of welfare that is missed out on, are called agency costs (Jensen & Meckling, 1976).

In this thesis, the agency theory will be discussed in the context of corporate governance. Literature about the agency theory in corporate governance states that the principal is the shareholder, and the agent is the manager. In firms, there is a separation between ownership and control. Shareholders are the owners of a firm, and management governs the firm in name of the shareholders (Jensen & Meckling, 1976). Shareholders want the highest possible return, as they provide the capital needed to keep the firm running.

Management has the responsibility to act in the best of their interest. Unfortunately, shareholders are not able to fully monitor and control the behaviour of managers. This will result in information asymmetry between these two parties. Due to information asymmetry, shareholders will not be able to see whether managers act in their best interest (Jensen, 1986). This will happen when there is a conflict of interest between a firm's management and their shareholders. There are multiple ways to counter this problem. For example, the directors and investors can include a contract, in which both parties record to share the information completely (Healy & Palepu, 2001).

Another option to counter this problem could be the board of directors. The board can monitor management, as shareholders are unable to do so. Keeping agency theory in mind, the board of directors should be independent of managers when making decisions (Donaldson & Davis, 1991). The role of the board is to monitor and control the executive management of a firm and by doing so representing the interests of both the shareholders and managers (Jensen, 1993). According to De Andres and Vallelado (2008) the board also has the responsibility to advise and challenge the strategy of a company and the implementation of it. By fulfilling these two tasks, the board can be a powerful corporate governance mechanism to direct management to act on behalf of the shareholders. A CEO or an employed director who is part of the board is called an inside or executive director.

2.2.2 Stewardship theory

Another theory, the opposite of the agency theory, is the stewardship theory. The latter states that, at the time that no supervision is exercised, management will act as responsible managers of the company, owned by the shareholders. Backed up by empirical evidence, managers should be applauded to take more autonomous decisions, instead of implementing more supervision (Donaldson & Davis, 1991). One of the reasons for this, according to the stewardship theory, is that management is intrinsically motivated. They are motivated by for example personal growth, and their own achievements. When acting in the interests of their firm, they will succeed in achieving these personal goals and other accomplishments. They identify themselves as part of the firm, and so when the firm is successful they feel successful themselves (Donaldson & Davis, 1991).

Ultimately, management has the incentive to act in a way that serves the firm best to maximize their own wealth. In addition, the stewardship theory states that the CEO and the board of directors do not have to be separated to function properly. This in contrast to what the agency theory predicts. The stewardship theory states that when the CEO is both CEO and chairman of the board simultaneously, it will improve productivity and high returns for the shareholders will be achieved (Donaldson & Davis, 1991).

2.3 Board of Directors

The board of directors is of great importance to companies. It gives high level council, and it controls and monitors management in the name of shareholders (Jensen, 1993). Shareholders are unable to do this themselves due to several reasons. For example, information asymmetry causes difficulties for shareholders to monitor managers. Another explanation could be that they own shares in different companies. This makes it even more difficult to monitor executives. These issues make the importance of the board of directors even greater, and lets the board turn into an important corporate governance institution. The board connects the interests of shareholders and management, and improving the effectiveness of the board can help align these interests.

2.3.1 Board composition

A lot of research has been done on board composition, and how it affects firm value. In current literature, there is a trade-off between the advantages and disadvantages of having non-executive directors on the board. For example, it is often the case that the CEO is also the chairman of the board of directors. The function of the chairman is to run board meetings, and to oversee the hiring and firing of executives, and compensation of the CEO (Jensen, 1993). When the CEO can make these decisions as the chairman of the board, he or she will clearly be influenced by personal interests. According to Jensen (1993), the board will not be able to critically monitor executives without an independent leader.

In addition, Rosenstein and Wyatt (1990) also found evidence that shareholder wealth is positively affected by the number of outside directors. A positive stock price reaction was found when an additional non-executive director was appointed. Harris and Ravis (2006) presented evidence that when agency issues are large, a company can benefit from having outside directors in their boards. Furthermore, Weisbach (1988) states that outside directors are more engaged in the monitoring of executives. Since inside directors are usually tied to the CEO, and have no incentive to remove bad performing CEO's. Outside directors are also usually respected leaders in the business and academic community. To be a director of a well-running companies will reflect their competence to fellow colleagues. This will create an incentive for outside directors to monitor executives more actively, which has a positive influence on firm value (Fama and Jensen, 1983).

However, literature does not give a conclusive answer about the association between board composition and firm value. Yermack (1996) found no evidence for any association between board composition and firm value. Hermalin and Weisbach (1991) also find no relation between board composition and firm value. Harris and Ravis (2006) explain that there can be a preference towards having relatively more inside directors, because they have important information which would then be lost. This would be costlier than the agency costs which are associated with having executive directors. Besides,

executive directors facilitate the transfer of information between board directors and the management. Thus, we might expect an independent board to have fewer conflicts of interest when monitoring managers. However, boards with a relatively larger proportion of non-executive directors might interfere with the advisory role of the board, which will result in a loss of information.

2.3.2 Board culture

Another issue which interferes with the effectiveness of the board of directors is board culture. Jensen (1993) addresses this problem, and argues that conflict is discouraged in boardrooms. The emphasis is put on politeness, which reduces the monitoring abilities of the board. Since conflict is discouraged, the CEO gets the power to control the board, the agenda and the information given by the board. This reduces firm and CEO performance (Jensen, 1993). Crystal (1992) explains that non-executive directors are afraid to disagree with the CEO, as they are often hired by the CEO and can be removed by the CEO again.

As stated above, board members avoide conflict with the CEO in boardrooms. This can result in the power of the CEO to determine when board meetings are held. According to De Andres and Vallelado (2008) board meetings are a chance for the board to come together, and to talk about their ideas and how they can monitor managers. In addition, discussions can be held about the strategy of the firm. Thus, the more frequent the meetings are held, the more control the board can exercise over managers, and the more advice they can give. This positively influences firm performance. However, when the CEO can determine the frequency of board meetings, the advisory role of the board can be affected, which could lead to a decline in firm performance (De Andres and Vallelado, 2008).

2.3.3 Board stock ownership

Morck, Shleifer and Vishny (1988) find a nonmonotonic, significant relation between different levels of equity holdings and firm value. To a certain extent, an increase in equity holdings will result in an increase of firm value. As their stakes are rising, they want to maximize firm value, and this results in an incentive to monitor management more actively.

After a certain proportion of equity holdings, the entrenchment effect will dominate the incentive effect. With a certain amount of equity, a director can have enough influence or voting power to guarantee his employment (Morck, Shleifer and Vishny, 1988). This will lead the director to behave in a non-value-maximizing way. Thus, according to Morck et al. (1988) it depends on the proportion of equity holdings of directors whether there is a positive association with firm value. Jensen (1993) and Yermack (1996) both find evidence for a positive association between firm value and stock ownership of directors. This could be because an incentive is created to monitor managers better, when directors have higher equity holdings.

2.3.4 Board size

Lipton and Lorsch (1992) state that corporate governance is not working the way it should be. The reason for this is explained in the paper, namely the failure of the board of directors to effectively monitor executives. They propose several measures that companies can implement to improve the functioning of the board, one of them is to limit board size (Lipton & Lorsch, 1992). They specify that a board of ten, preferably eight or nine, should be implemented. Jensen (1993) recommends a board size of seven or eight. Jensen (1993) argue that larger boards function less effectively and are easier for the CEO to control. Both papers give several reasons why smaller boards are more effective.

As mentioned, the number board meetings per year influences the monitoring abilities of the board. A typical board meets eight times per year, has a limited amount of time to discuss management performance, and almost no time for a meaningful exchange of ideas (Lipton & Lorsch, 1992). When the board becomes too large, it will become difficult for all board members to express their ideas and usefull information. This will prevent the board from executing their duties effectively, and productivity will decline.

In addition, larger boards cause politeness to prevail in expense of truth and frankness, in boardrooms. Since the possibility of retribution by the CEO is too big, board members will not be able to critically monitor the CEO and other executives (Jensen, 1993). Lipton and Lorsch (1992) share this view, and state that how larger the board becomes, the more difficult it will be to criticize top executives and discuss strategy. Larger boards also have relatively more difficulties with the coordination, flexibility and control of the decision-making process (Lipton & Lorsch, 1992). It takes them longer to come to a decision, and when the board becomes bigger more directors must make compromises.

Hence, a trade-off can be seen between the advantages and disadvantages of a small board of directors. A large board could improve the monitoring and advising abilities, as more human capital is added to the board (De Andres and Vallelado, 2008). On the contrary, bigger boards make the decision-making process of boards less efficient, and it is then easier for the CEO to control them.

Numerous studies can be found regarding the association between firm performance, and having independent board members. As mentioned, non-executive board members are more engaged in the monitoring of executives. However, these non-executive board members are usually not found in smaller boards (Yermack, 1996). Board size is negatively correlated with the proportion of executive directors, such as corporate insiders. Board size is positively correlated with non-executive directors, and they are more likely to have CEO's who founded the company (Yermack, 1996). This characteristic is usually associated with relatively lower firm value (Johnson, Magee, Nagarajan & Newman, 1985). Yermack (1996) finds evidence that when the family surrenders control, firm value increases.

Nevertheless, smaller boards usually have a higher proportion of equity holdings, which creates an incentive to monitor managers better (Yermack, 1996). However, a relatively higher proportion of stock equity ownership can also make directors behave in a non-value-maximizing way. (Morck, Shleifer and Vishny, 1988). In addition, Yermack (1996) states that small boards usually have more active monitors in their board, such as major stockholder-directors or a non-CEO chairman. This will positively influence firm value.

Yermack (1996) conducted research regarding the effect board size on firm value. His research found an inverse association between board size and firm value, where the association seems to have a convex shape. This suggests that when boards grow from relatively small to medium size boards, the biggest fraction of firm value is lost. In the paper, it is explained that these findings are consistent with the interpretation that larger boards cause the decision-making to become more complex, which affects firm value. Yermack (1996) also presents evidence that costs accumulate at a decreasing rate when board size increases.

In his research, the potential threats, methodology and choices of variables were extensively argued. Other studies also found an inverse and convex shape, regarding the association between firm value and board size, such as De Andres and Vallelado (2008). Hence, I've chosen to pursue this inverse, convex relation by Yermack (1996), resulting in the following hypothesis:

Hypothesis 1: The effect of board size on firm value has a convex shape.

To specify the relationship that is addressed in the first hypothesis, three hypotheses are drawn which reflect on the association between board size and operating performance, CEO turnover and CEO compensation.

If an increase in board size results in a less effective board of directors, it can be expected that companies with large boards have lower profitability. It can also be expected that they use their assets less efficient, and have lower profits (Yermack, 1996). As several prior studies suggested, when board size increases it will be harder to reach consensus. Compromises must be made, and the decisions taken by large boards are less extreme (Cheng, 2008). In addition, large boards make the CEO more powerful, which helps them gain influence on the decision-making process (Jensen, 1993). This also causes the board of directors to make less extreme decisions, resulting in less extreme firm and operating performance (Cheng, 2008).

Furthermore, several articles can be found which specify the relationship between operating performance and board size to certain industry characteristics and/or countries. Eisenberg, Sundgren and Wells (1998) find an association between board size and several financial ratios for small and midsize firms. Concluding that agency problems also extend to smaller firms, even though there is less of a separation between ownership and control, compared to large firms.

Conyon and Peck (1998) conduct a similar research as Yermack (1996), but they focus on several European economies. The article uses return on shareholder equity as their variable to measure profitability. According to Conyon and Peck (1998), return on shareholder equity also captures the efficiency of assets used by management. A negative association is found between board size and return on shareholder equity (Conyon & Peck, 1998). These findings indicate that in European economies larger boards use their assets less efficiently, which results in lower profits. Based upon the literature, the following hypothesis is constructed regarding the relation between board size and operating performance:

Hypothesis 2: There is a negative association between board size and operating performance.

Some prior literature can be found about CEO turnover, and how it can be used as a corporate governance mechanism. For example, Weisbach (1988) conducted a research about how boards who have a relatively larger proportion of non-executives react to the performance of a CEO. The evidence suggests that boards which consist of more non-executives are more likely to remove CEO's based on their performance. This can be explained with prior knowledge, namely that outside directors are more engaged in monitoring executives as they are not tied to the CEO (Weisbach, 1998). He also explains that CEO shareholdings can affect CEO turnover. If the CEO has more power, it will become harder to remove him from the firm. It can be expected that if a CEO owns a significant amount of shares in a firm, the chance that a CEO is removed decreases (Weisbach, 1988).

Coughlan and Schmidt (1985) find a negative relation between firm performance and CEO turnover. Their findings suggest that management replacement decisions by boards cause the interests of executives to align with the owners of the firms. Warner, Watts and Wruck (1988) also find an inverse relation between firm performance and CEO turnover, and they suggest this is the result of monitoring by the board.

As mentioned above, Lipton and Lorsch (1992) and Jensen (1993) state that larger boards avoid conflict in boardrooms, caused by the fear of retribution by the CEO. This emphasis is put on politeness, and it prevents critical monitoring of the CEO. Therefore, a weaker connection can be expected between firm performance and CEO turnover for larger boards. Yermack (1996) finds evidence that due to these circumstances companies with small boards have a higher CEO turnover rate. This rate declines as board size increases. However, small boards might also have a lower CEO turnover rate because companies with small boards perform better (Yermack, 1996). Therefore, CEO's will be relatively less often dismissed for poor performance. Subsequently, a negative association between board size and CEO turnover will be hypothesized according to the research of Yermack (1996) and Weisbach (1988), which is stated as follows:

Hypothesis 3: There is a negative association between board size and CEO turnover.

CEO equity holdings can influence CEO compensation levels. However, relatively few studies can be found concerning ownership structure and CEO compensation. The available literature also does not give a conclusive answer about the relation between both. Allen (1981) presents evidence that the equity proportions held by the CEO is negatively associated with the level of CEO compensation. The reason given was that CEO's earn considerably more than others because of the dividend paid on their stocks. Contrary to these findings, Holderness and Sheehan (1988) find a positive association, which indicates that CEO's receive higher salaries and bonuses when they are majority shareholders. One of the explanations given is that majority shareholders use their voting power to gain a significant amount of the company's wealth.

In addition, CEO compensation can be influenced by the board of directors through multiple ways. Crystal (1992) argues that the board is ineffective when it comes to setting the appropriate levels of compensation. The reason Crystal (1992) gives is that outside directors are hired by the CEO, and hence can be fired by the CEO. Therefore, board members are hesitant to make critical comments concerning CEO compensation. In addition, consultants are usually hired to determine compensation levels. This then may lead to compensation contracts that are reformed for the CEO, and not the firm.

Board size is another reason why directors are hesitant to critically comment on CEO's. Yermack (1996) finds evidence that when boards are relatively smaller, CEO's receive stronger compensation incentives. This means that smaller boards are more effective in creating managerial incentives through compensation contracts. According to Core, Holthausen and Larcker (1999) CEO compensation is a positive function of board size. They state that when corporate governance is weak, compensation levels of CEO's will rise. This makes sense, as e.g. larger boards make it easier for the CEO to control the board, and thus influence the board to raise his or her compensation (Core et al., 1999). In the paper, it is also explained that the level of pay is an increasing function of firm performance. To analyse the expected positive association between CEO compensation and board size the following hypothesis is constructed:

Hypothesis 4: CEO compensation has a positive association with board size.

The four hypotheses will be further discussed and elaborated in section 5. Multiple regression analysis will be done to accept or reject the hypotheses.

3 Data

In this section the sample is described, as well as the sample selection procedure. Furthermore, a description is given for the variables which are used to perform the regressions. Finally, the descriptive statistics are presented and discussed.

3.1 Data Description

My analysis uses two samples of panel data, which consists of firms that belong to the oil and gas industry in the US. The fist sample is used for the first two hypotheses, the second sample for the last two hypotheses. These companies are acquired through the following four-digit standard industry classification codes: 1300-2999. Most of the financial data is obtained from the database Compustat. Governance data is obtained partly from Boardex and partly from the Institutional Shareholder Services database. Boardex provides us with the characteristics of boards, such as board size and board composition. Institutional Shareholder Services facilitates data on for example what kind of governance structures a company has. The missing data of board size and board composition were partly manually obtained from annual meeting proxy statements.[1]

I use a sample selection procedure in which each company must have four or more consecutive years of financials statement data of the eight-year sample period between 2010 and 2017. In addition, board size must be available for four or more years of the sample period. Both restrictions will help limit survivorship bias, as it allows companies to enter and leave the data sample over time. It also enhances the usefulness of several statistical techniques when you have multiple observations per company. In addition, I dropped the companies where total assets or sales were equal to zero in the dataset. I finally end with a sample of 1470 observations and 213 companies for the first two hypotheses. The second sample consists of 363 observations for 69 companies across eight years.

3.2 Variables Descriptions

3.2.1 Dependent variables

I measure Tobin's Q by using the market value of assets divided by the replacements costs of assets, as a proxy for firm value. Many other studies can be found that either use this method or a similar method for the dependent variable in research on board effectiveness (e.g. Morck et al., 1988; Hermalin and

[1] Due to time constraints, not all the missing data could be filled up by checking the annual meeting proxy statements.

Weisbach, 1991; Yermack, 1996). The dependent variable is measured at the end of the fiscal year for the period between 2010 and 2017.

I use three measures of financial ratios for my second hypothesis to see whether large boards use their assets less efficient. The variables are the return on assets (ROA), return on sales and the ratio of sales over total assets. I calculate ROA by dividing net income by total assets. Return on sales is estimated as operating income over net sales (Yermack, 1996).

For my third hypothesis CEO turnover is used as the dependent variable. Following the approach of Yermack (1996), CEO turnover is a dummy variable which equals one if the CEO leaves his position before the end of the current fiscal year, and zero if the CEO stays in his position.

My last hypothesis has the natural logarithm of CEO compensation as its dependent variable. This variable is estimated by adding salary and bonus of the CEO together in thousands of US dollars, based on the approach of Core, Holthausen and Larcker (1999).

3.2.2 Independent variables

Board size is the main independent variable. I use a natural log specification for the board size variable, based upon the belief that there is a convex association between board size and firm value (Yermack, 1996). The mean and median values of Tobin's Q for firms sorted by board size are illustrated in Figure 1. Board size is measured by the number of directors inside of a board. Board size was either collected from Boardex or manually obtained from proxy statements for firms' annual meetings, which usually take place in the fifth or sixth month of each fiscal year. For firms between four and eight directors in the board, mean and median values of Tobin's Q vary between 1 and 1.5. A slight rise can be seen when board size reaches eleven. Next to board size, I use multiple control variables in my regressions for which I expect that they will directly influence Tobin's Q, or the other dependent variables, or influence the board's ability to monitor managers.

Return on assets is used as a control variable. The way I estimate this variable is described above. ROA is used because profitability of a company influences firm value, CEO turnover and CEO compensation. In addition, ROA is a common measurement in studies about the board of directors (Himmelberg et al. 1999).

To account for future investment opportunities, which influences firm value, I add another independent variable. I use the ratio of capital expenditures over sales as a proxy for future investment opportunities. The relationship between firm value and future investment opportunities is established in several studies (Myers, 1977). The proxy for future growth opportunities is also added in the fourth hypothesis because it can be expected that larger firms with greater growth opportunities, and complex

operations will want to have experienced managers who have higher wages (Core, Holthausen and Larcker, 1999).

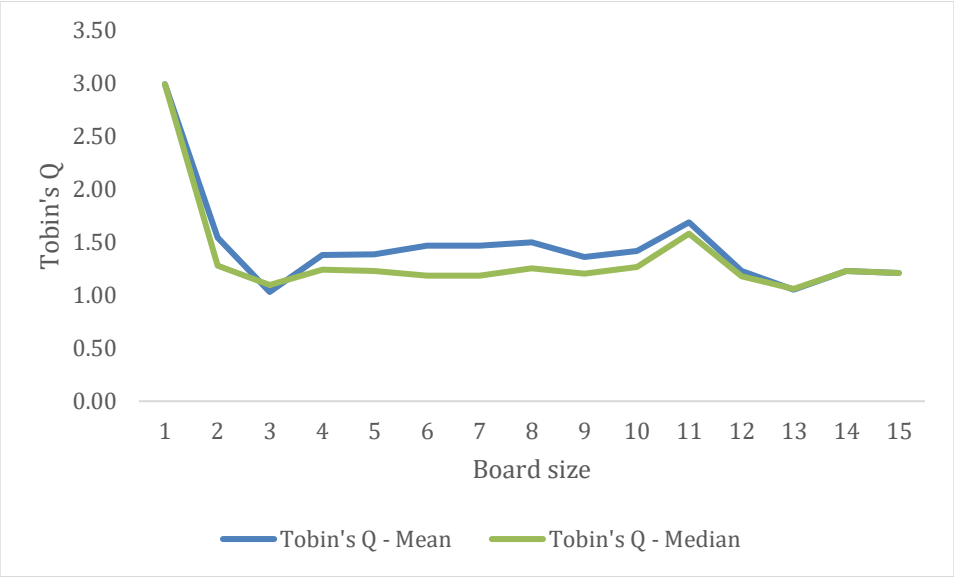

Figure I. Board size and Tobin's Q: Sample means and medians. *Note.* Sample means and medians of Tobin's Q for different sizes of boards of directors. The sample consists of 1633 observations for 214 companies between the period 2010 and 2017 in the U.S. oil sector. Tobin's Q is estimated at the end of the fiscal year by dividing market value of assets over the replacement costs of assets.

I account for board composition by using the proportion of outside directors on the board, which I estimate as the number of non-executive directors out of the total number of directors. Boardex has data of three different measures of board composition: inside directors, affiliated directors and independent directors. Affiliated directors are not included for the first hypothesis, solely the independent outside directors are used to the examine effect of board composition. Literature gives mixed results on the effect of outside directors. Hence, I make no expectations whether the proportion of outside directors will positively or negatively influence firm value. However, the association between outside directors and CEO turnover I expect to be negative. According to Weisbach (1988) outside directors monitor CEO's more actively, and are more likely to dismiss CEO's based on their performance.

I did add the variable affiliated directors for the fourth hypothesis, which I collected from the database Boardex. Affiliated directors are defined as relatives of the company's officers, and who benefit from close personal business ties to the firm (Yermack, 1996). According to Core, Holthausen and Larcker (1999) an affiliated director is less independent of the CEO, and monitors the CEO less actively compared to an independent director. Hence, a positive association might be expected between CEO compensation and the proportion of affiliated directors.

To measure for ownership structure, the proportion of shares owned by CEO's is used as a variable. The data for this variable is obtained from Execucomp. I expect a negative relation between CEO turnover and CEO shareholdings, because when the CEO has a large stake in the firm it will be more difficult to replace him (Weisbach, 1988). However, I expect a positive association between the proportion of shares owned by the CEO and CEO compensation, based on the findings of Holderness and Sheehan (1988). In addition, CEO age is added as an independent variable, where dummy variables are made for ages 64, 65 and 66. These CEO turnovers usually represent the retirement of the CEO.

Furthermore, I define a dummy variable that takes the value of one when the CEO and the chairman of the board are the same person, and zero otherwise. I expect this variable to positively influence CEO compensation, as empirical studies have shown that agency problems are higher when the CEO is chairman simultaneously (Core, Holthausen & Lacker, 1996). Hence, the monitoring abilities of the board become less effective, and this creates the possibility for the CEO to earn higher compensation levels. To control for firm size, I use the natural log of total capital. Total capital is calculated by adding the market value of equity, long-term debt, and preferred stock together measured in millions of US dollars (Yermack, 1996). Finally, I include dummy variables for individual years to consider the year-specific characteristics.

3.3 Descriptive Statistics

The descriptive statistics are shown in Table I. Board size ranges between two and sixteen for the first sample of firms, and between five and nineteen for the second sample. With a median of eight for the former, and nine for the latter. Yermack (1996) found higher medians, namely a median of twelve. Tobin's Q has a slight negative correlation of -0.07 with board size, which is consistent with the main hypothesis of this thesis, and the findings of Yermack (1996).

On average, outside directors account for 81% of directors, similar to the findings of de Andres and Vallelado (2008). The median board in the oil sector comprises eight board members, which indicates that the median board consists out of six outsiders and two insiders. In addition, the proportion of outsiders also has a positive correlation of 0.36 with board size, which corresponds with the findings of Yermack (1996).

There is a positive correlation of 0.15 between board size and the CEO being chairman of the board, which is in line with the findings of Yermack (1996). These findings indicate that smaller boards are less likely to have a CEO as chairman. In my sample 49% of the CEO's were simultaneously the chairman of the board. In addition, CEO turnover has a negative correlation of -0.05, which indicates that smaller boards are more likely to dismiss CEO's, which corresponds with the literature (Weisbach, 1988 & Yermack, 1996). The average proportion of shares owned by CEO's within a company is 28%, with a minimum of 0.2% and a maximum of 99%. There is a negative correlation of -0.38 between board size and the proportion

of shares owned, which matches the findings of Yermack (1996). This leads to the interpretation that CEO's of smaller boards tend to own a higher proportion of shares.

CEO compensation has a positive correlation of 0.12 with board size. This is consistent with the findings of Yermack (1996), which means that bigger boards could be easier for the CEO to control. Hence, it is easier for the CEO to arrange higher compensation for himself/herself. ROA and the other firm performance measures all have positive correlations, which is contradiction with the findings of Yermack (1996). He expects that smaller boards are ineffective in monitoring managers, which would then lead to lower firm performance. However, a larger board has more knowledge when it comes to advising managers, which positively influences firm performance. To conclude, average firm size, measured by the natural log of total capital, is 10,698 US million dollars. The average of the variable for future investment opportunities is 1.18, and the average CEO age is 58.

Table 1
Descriptive Statistics

Variable Name:	Avg (StDev)	Min Max	Median	Correlation with board size	Observations
Dependent variables:					
Tobin's Q	2.59 (34.04)	0.76 8.04	1.23	-0.07	1633
Return on Assets	-0.3 (10.34)	-12.70 0.58	0.0	0.12	1633
Sales/Total Assets	1.42 (3.51)	0.01 4.73	1.03	0.14	1633
Return on Sales	0.27 (8.46)	-0.99 0.94	-0.59	0.14	1633
CEO Turnover	0.103 (0.304)	0 1	0	-0.05	401
CEO Compensation	1,418.219 (1,618.974)	309 18,602	1,000	0.12	401
Independent variables for firm value and profitability:					
Board size	8 (2.34)	2 16	8	1.00	1633
Total Capital	10,698 30,284.34	200 329,298	1,311	0.41	1633

Outsiders	0.81 0.12	0.40 1	0.83	0.36	1633
Capital expenditures/Sales	1.18 4.48	0.11 44.00	0.41	-0.12	1633
Independent variables for CEO Turnover & Compensation:					
Board size	9 (2.14)	5 19	9	1.00	401
Total capital	18,746 (34,431.47)	291 212,094	6,707	-0.05	401
Capital expenditures/Sales	0.54 (0.56)	0.01 3.95	0.38	-0.27	401
CEO Shares %	0.28 (0.25)	0.002 0.99	0.19	-0.38	401
CEO Age	57 (6.27)	35 82	58	-0.04	401
Outsiders	0.818 (0.094)	0.5 0.95	0.85	0.309	401
Affiliated	0.043 (0.076)	0 0.38	0.00	-0.103	401
ROA	-0.02 (0.173)	-1.329 0.167	0.03	0.144	401
CEO & Chair	0.494 0.501	0 1	0	0.15	401

Note. Tobin's Q is a proxy for firm value, and is measured for each company at the end of the fiscal year by dividing the market value of assets over the replacement costs of assets. Return on assets (ROA) is measured by dividing net income over total assets. Return on sales is measured by dividing operating income over total sales. CEO Turnover is one if the CEO leaves his position during the fiscal year, and zero otherwise. CEO compensation is the salary and bonus of the CEO together in thousands of US dollars. Board size is estimated by using the natural log of the number of directors on the board, as reported in annual proxy statements. Total capital is a proxy of firm size, and is measured by adding the market value of equity, long-term debt, and preferred stock together measured in millions of US dollars. Outsiders is the proportion of independent directors on the board. The ratio capital expenditures over sales is a proxy for future growth opportunities. CEO shares is the proportion of shares owned by the CEO within a company. CEO age is the age of the CEO. Affiliated is the proportion of directors which are relatives of the company's officers, and who benefit from close personal business ties to the firm. CEO & Chair is a dummy variable which equals one if the CEO is the chairman of the board and zero otherwise.

4 Methodology

In this thesis, the relationship between firm value and board size in the US oil sector will be analysed. To get answers on the hypothesis, a variety of regressions will be constructed with multiple dependent and independent variables. In this section the research approach is further elaborated with more detail.

4.1 Empirical Model

Panel data analysis is the most efficient tool to use when the sample is a combination of cross-sectional and time series data (de Andres and Vallelado, 2008). The panel data structure allows us to consider the unobservable specific features of each firm. However, some of my independent variables, such as board size, or the proportion of outside directors might be influenced simultaneously with the dependent variable. Hence, a model is needed to deal with endogeneity, and the possibility of unobservable fixed effects that are related to each firm and correlated with the rest of the independent variables.

It is likely that unobservable characteristics are going to affect each company's market value, and so pooled ordinary least squares (OLS) regressions estimations will be biased and inconsistent. Hence, I also perform fixed effects regressions to deal with the problem of endogeneity. According to Hausman and Taylor (1981) the fixed-effects model is a common, unbiased method of controlling for omitted variable bias in a panel data set. Fixed effects partly help with the endogeneity problem by controlling for unobservable firm-specific characteristics that have not changed over time.

However, it should be considered that most of the variation in the boards used in my sample vary in the cross section, and not in the time series. The correlation between board size and the lagged value of board size is 0.88. Also, a significant amount of boards did not change over time in size in this thesis. If this is the case, fixed effects estimates will be inconsistent. An approach to eliminate this problem is to use instrumental variables to deal with endogeneity.[2]

4.2 Regressions

For my first hypothesis, the relation between firm value and board size is analysed. The model considers the possibility of a nonlinear relation, with one year lagged values for all independent variables. Tobin's Q (Q) is the dependent variable, which is used as a proxy for firm value. The independent variables are the natural log of board size (BOASIZE), the return on assets (ROA), the natural log of total capital which is a proxy for firm size (TOTCAP), capital expenditures over sales as a proxy for future investment opportunities (CAPSA), and the proportion of outsiders in the board (OUTSIDERS). Both an OLS

[2] Due to time restraints, I did not go so far as to use instrumental variables.

regression and fixed effects regression are performed. Thus, the regression model for the first hypothesis is stated as follows:

(1) $Q_{i,t} = \alpha + \beta_1 \ln(BOASIZE)_{i,t-1} + \beta_2 ROA_{i,t-1} + \beta_3 \ln(TOTCAP)_{i,t-1} + \beta_4 CAPSA_{i,t-1} + \beta_5 OUTSIDERS_{i,t-1} + \epsilon_{i,t}$

For my second hypothesis, the relation between different profitability measures and board size is evaluated. Sales over total assets (STA), return on assets (ROA), and return on sales (ROS) are the three dependent variable. The independent variables are board size (BOASIZE), the natural log of total capital which is a proxy for firm size (TOTCAP), and the proportion of outsiders in the board (OUTSIDERS). I did not add the proxy for future growth opportunities, as it is not obvious why that should influence current profitability (Yermack, 1996). Fixed effects regressions are constructed for all three regressions, and one year lagged values are used for all independent variables. Hence, the following regressions are constructed to test the second hypothesis:

(2) $STA_{i,t} = \alpha + \beta_1 \ln(BOASIZE)_{i,t-1} + \beta_2 \ln(TOTCAP)_{i,t-1} + \beta_3 OUTSIDERS_{i,t-1} + \epsilon_{i,t}$

(3) $ROA_{i,t} = \alpha + \beta_1 \ln(BOASIZE)_{i,t-1} + \beta_2 \ln(TOTCAP)_{i,t-1} + \beta_3 OUTSIDERS_{i,t-1} + \epsilon_{i,t}$

(4) $ROS_{i,t} = \alpha + \beta_1 \ln(BOASIZE)_{i,t-1} + \beta_2 \ln(TOTCAP)_{i,t-1} + \beta_3 OUTSIDERS_{i,t-1} + \epsilon_{i,t}$

For the third hypothesis, the association between CEO turnover and board size is analysed. The dummy variable for CEO turnover (CEOTURNOVER) is the dependent variable. The independent variables are the natural log of board size (BOASIZE), CEO age (CEOAGE), dummy variables for ages 64, 65 and 66 (OLDAGE), the return on assets (ROA), the proportion of shares owned by CEO's (CEOSHARES), the proportion of outside directors (OUTSIDERS) and the log of total capital which is a proxy for firm size is added (TOTCAP). A probit model is constructed with one year lagged values for the independent variables, which is stated as follows:

(5) $CEOTURNOVER_{i,t} = \alpha + \beta_1 \ln(BOASIZE)_{i,t-1} + \beta_2 \mathrm{CEOAGE}_{i,t-1} + \beta_3 OLDAGE_{i,t-1} + \beta_4 ROA_{i,t-1} + \beta_5 CEOSHARES_{i,t-1} + \beta_6 OUTSIDERS_{i,t-1} + \beta_7 \ln(TOTCAP)_{i,t-1} + \epsilon_{i,t}$

For the last hypothesis, the relation between CEO compensation and board size is analysed. The dependent variable is the natural log of CEO compensation (CEOCOMP). The independent variables are the natural log of board size (BOASIZE), the proportion of shares owned by the CEO (CEOSHARES), a dummy variable if the CEO is also chairman of the board (CEOCHAIR), the ratio of capital expenditures over sales as a proxy for future investments (CAPSA), the return on assets (ROA), the proportion of

affiliated directors (AFFILIATED), and the natural log of total capital which is a proxy for firm size (TOTCAP). An OLS regression is done with one year lagged values for all independent variables, which is constructed as follows:

$$(6)\ \ln(CEOCOMP)_{i,t} = \alpha + \beta_1 \ln(BOASIZE)_{i,t-1} + \beta_2 CEOSHARES_{i,t-1} + \beta_3 CEOCHAIR_{i,t-1} + \beta_4 CAPSA_{i,t-1} + \beta_5 ROA_{i,t-1} + \beta_6 AFFILIATED_{i,t-1} + \beta_7 \ln(TOTCAP)_{i,t-1} + \epsilon_{i,t}$$

5 Results

This section shows the results of the multiple OLS and fixed-effects regressions. With these results, the hypotheses can be either accepted or rejected.

5.1 Board Size and Firm Value

Table II shows the results of the OLS and fixed-effects models. The OLS estimators are not consistent, as they do not consider the unobservable heterogeneity of the firms in my sample, nor the endogeneity of the independent variables. The results show a positive insignificant relation between board size and firm value, which disagrees with my main hypothesis. The OLS results can be caused due to non-consideration of the fixed effects, and the presence of correlation amongst the independent variables.

However, the fixed-effects estimates do show an inverse and significant relation between firm value and board size, as well as when dummies for individual years are added. The fixed-effects estimate for the board size log coefficient of -0.356 means that Tobin's Q falls by -0.178 when board size increases with 50%. This change is economically significant. Figure 1 shows that the median firm in my sample has a market value of $1.5 billion and a Tobin's Q close by 1, a change in Tobin's Q of 0.01 reduces firm value by $15 million for the median firm.

The downward slope gives an indication that decision-making and communication problems increase when the number of directors increase (Yermack, 1996). The log of the board size variable implies a convex association between board size and firm value. This indicates that costs accumulate at a decreasing rate as board size grows (Yermack, 1996). When regressing against different functional forms of board size, namely board size and board size squared the results differ. The estimates for both functional forms show an inverse association. However, the estimates when using board size are significant (with a ρ-value of 8%), and when using board size squared insignificant.

In addition, for robustness checks of my results I checked different definitions of the firm size variable. The additional measures are assets and net sales during the prior fiscal year. Using the natural log of both variables, an inverse and significant association appears for the fixed effects models. The results can be seen in the Appendix Table AI and AII.

Coefficient estimates for the other variables in Table III are mostly significant in the fixed-effects models. In the OLS regressions all control variables are insignificant. This could be caused by omitted variable bias, which is a problem with OLS models (Hausman and Taylor, 1981). Hence, the fixed-effects estimates are more reliable to comment on. Profitability of firms, measured by ROA, is negatively associated with Tobin's Q. The board composition variable, proportion of outside directors, seems sensitive to the fixed-effects model as the coefficients signs flip. In the literature, the findings are ambiguous concerning the relation between board composition and firm value. However, my result is inconsistent with

the findings of Yermack (1996). Capital expenditures over sales is significant in the fixed-effects models. However, the coefficient becomes negative when including fixed-effects which is unexpected considering Yermacks (1996) results. Firm size, when measured by the natural log of total capital, is negatively associated with Tobin's Q.

Even though the results show an inverse significant association between a smaller board size and a higher firm value, there is some caution needed when evaluating these results. In my sample, most of the boards vary between five and eleven. Only 36 firms have boards smaller than five, and 86 firms have boards higher than eleven. Figure I display of mean and median values of Tobin's Q indicate that there is no consistent relation for firms which have lower than five board members. In addition, within estimators are only consistent when the independent variables are exogenous. Which is most likely not the case in this thesis.

Table II
Regression coefficient estimates: board size and market valuation

	(1)	(2)	(3)	(4)	(5)	(6)
Dependent Variable			*Tobin's Q*			
Constant	10.046	1.699***	1.893***	10.564	4.007***	3.466***
	(6.764)	(0.525)	(0.544)	(7.451)	(0.687)	(0.767)
Ln Board size (LAG)	-3.631	0.036	0.027	-3.884	-0.372*	-0.356**
	(2.809)	(0.272)	(0.272)	(3.651)	(0.193)	(0.170)
Ln Total Capital (LAG)		-0.058	-0.060		-0.138	-0.081
		(0.059)	(0.061)		(0.105)	(0.124)
Capital expenditures/Sales (LAG)		0.001	0.007		-0.042***	-0.045***
		(0.008)	(0.010)		(0.008)	(0.010)
Outsiders percentage (LAG)		0.105	0.233		-0.839	-0.553
		(0.538)	(0.522)		(0.223)	(0.498)
ROA (LAG)		0.186	0.373		-0.223*	-0.216*
		(0.240)	(0.361)		(0.121)	(0.122)
Firm fixed effects	No	No	No	Yes	Yes	Yes
Years fixed effects	No	No	Yes	No	No	Yes
R^2	0.001	0.015	0.066	0.000	0.125	0.202

Observations	1470	1470	1470	1470	1470	1470

Notes. Regression coefficient estimates of the association between Tobin's Q and the number of directors on the board. Coefficients appear with standard errors clustered by firm (in parentheses). The sample consists of 1470 annual observations for 213 companies between 2010 and 2017 in the US oil sector. The dependent variable is an estimate of Tobin's Q at the end of each fiscal year. Board size is estimated by using the natural log of the number of directors on the board as reported in annual proxy statements. The ln of total capital is a proxy for firm size. The first three columns present OLS estimates, the last three columns present fixed effects estimates. Both models include dummy variables for individual years. Other variables are as defined in Table I. LAG indicates that the variable was lagged by one year. Significant at 1%(***), 5%(**) and 10% levels(*).

5.2 Board Size and Financial Ratios

Table III presents the fixed-effects estimates for the second hypothesis. None of the models have a significant association with board size. In addition, none of the models shows results with the expected negative sign between financial ratios and board size. Thus, no conclusions can be made regarding the expected association that larger boards use their assets less efficient and earn lower profits (Yermack, 1996). This could be caused by the fact that most of the variation in board size happens in the cross section, which could cause fixed-effects models to not detect any effect. Another reason could be that the measurement of my dependent variables varies with Yermacks (1996) approach. He compounded the dependent variables continuously, which I did not do.

In the first model, with ROA as its dependent variable, the control variable for board composition is significant and indicates a negative association between firm performance and the proportion of outside directors. However, when adding dummies for years the variable loses his significance. That none of the other variables for board composition are significant might be because this variable has a lot of missing values in my dataset.[3] Firm size is only significant for the fifth and sixth model, and contrary to previous literature I find a negative effect of firm size on the dependent variables. This result might be biased as I did not add the control variable officer and director stock ownership, which Yermack (1996) did add.

Table III
Fixed-effects estimates: Board size and financial ratios

	(1)	(2)	(3)	(4)	(5)	(6)
Dependent variable	*Return on Assets*	*Return on Assets*	*Return on Sales*	*Return on Sales*	*Sales/Assets*	*Sales/Assets*
Constant	1.069**	0.610	20.850	22.145	0.956***	0.789**
	(0.499)	(0.569)	(16.009)	(19.344)	(0.318)	(0.337)

[3] Due to time constraints, the missing values were not filled up by checking the annual proxy statements of the firms.

Ln Board size (LAG)	0.001	0.062	2.819	3.087	0.022	0.048
	(0.079)	(0.071)	(2.924)	(2.922)	(0.111)	(0.103)
Ln Total capital (LAG)	-0.089	-0.053	-2.648	-2.780	-0.051***	-0.046*
	(0.059)	(0.069)	(2.109)	(2.396)	(0.017)	(0.025)
Outsiders percentage (LAG)	-0.514*	-0.335	-7.024	-8.103	-0.159	0.045
	(0.236)	(0.221)	(5.174)	(6.455)	(0.218)	(0.219)
Firm fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Years fixed effects	No	Yes	No	Yes	No	Yes
R^2	0.036	0.206	0.035	0.050	0.012	0.151
Observations	1470	1470	1470	1470	1470	1470

Notes. Coefficient estimates for fixed-effects regressions models of financial ratios. Coefficients appear with standard errors clustered by firm (in parentheses). The sample consists of 1470 observations for 213 firms in the period between 2010 and 2017 in the US oil sector. The dependent variables are three measures for operating performance. The first one is return on assets, the second is return on sales and the third is the ratio sales over assets. The main explanatory variable is the natural logarithm of board size, which is the number of directors on the board. The ln of total capital is a proxy for firm size. The three dependent variables and the other control variables are described in Table I. Dummies for individual years are included. LAG indicates that the variable was lagged by one year. Significant at 1%(***), 5%(**) and 10% levels(*).

5.3 Board Size and CEO Turnover

In Table IV presents the results of the probit model for the third hypothesis. The natural log of board size variable has a positive, though insignificant association with CEO turnover. These findings are contrary to previous literature. The result of this hypothesis might be biased as only 10% in my dataset switches CEO in a time frame of eight years. In addition, the dataset might be too small to be able to make any significant conclusions. Omitted variable bias might also influence the results, as Yermack (1996) uses a firm's current cumulative abnormal stock return, and two prior years as its performance measurement. I use return on assets as my firm performance measurement, lagged by one year. The other control variables are not significant, except for CEO age which has the expected positive sign.

Table IV

Probit coefficient estimates: Board size and CEO dismissal incentives

	(1)	(2)
Dependent Variable	*CEO Turnover*	

Constant	-2.021**	-6.008***
	(1.077)	(2.047)
Ln Board size (LAG)	0.335	0.825
	(0.463)	(0.658)
CEO age (LAG)		0.061*
		(0.024)
ROA (LAG)		0.313
		(0.987)
CEO share ownership (LAG)		0.034
		(0.035)
Outsiders Percentage (LAG)		-0.145
		(1.224)
Ln Total Capital (LAG)		-0.066
		(0.109)
R^2	0.003	0.131
Observations	363	363

Notes. Regression coefficient estimates for a binary model of CEO turnover. The dependent variable equals one if a CEO leaves his position during the fiscal year, and zero otherwise. The main explanatory variable is the natural logarithm of board size, which is the number of directors on the board. The other control variables are described in Table I. The sample consists of 363 observations for 69 companies between 2010 and 2017 in the US oil sector. Coefficient estimates appear with White (1982) robust standard errors. The second model also includes dummy variables for CEO ages 64, 65, and 66, and dummy variables for individual years. LAG indicates that the variable was lagged by one year. Significant at 1%(***), 5%(**) and 10% levels(*).

5.4 Board Size and CEO Compensation

Table V presents the results of the OLS estimates for the last hypothesis. Contrary to previous literature, the association between board size and CEO compensation is negative, and not significant. This could be caused by a too small dataset which has been used for this hypothesis. Omitted variable bias might also influence my results as Core et al. (1999) include several additional control variables, such as external block holders.

CEO share ownership has mixed results when reading prior literature. The positive and significant result is in line with the results of Holderness and Sheehan (1988). These results indicate that when CEO's have higher equity holdings they can use their voting power to acquire more of the company's wealth. Firm size has a positive and significant association with CEO compensation. According to Core et al. (1999) larger firms pay higher CEO compensation. This reflects their demand for managers with higher quality.

Table V

OLS estimates: Board size and CEO compensation incentives

	(1)	(2)
Dependent Variable	*CEO Compensation*	
Constant	4.978***	5.166***
	(0.311)	(0.315)
Ln Board size (LAG)	0.887***	-0.232
	(0.133)	(0.166)
ROA (LAG)		0.055
		(0.123)
CEO share ownership (LAG)		0.041***
		(0.014)
CEO & Chair (LAG)		0.006
		(0.045)
Capital Expenditures/ Sales (LAG)		-0.031
		(0.054)
Affiliated Percentage (LAG)		0.366
		(0.314)
Ln Total Capital (LAG)		0.285***
		(0.028)
R^2	0.121	0.463
Observations	363	363

Notes. Regression coefficients for an OLS model of CEO compensation. The dependent variable is the salary and bonus together of a CEO in thousands US dollars. The main explanatory variable is the natural logarithm of board size, the number of directors on the board. The rest of the control variables are explained in Table I. The sample consists of 363 observations for 69 firms in the period between 2010 and 2017 in the US oil sector. Coefficient estimates appear with White (1982) robust standard errors. The model includes dummies for individual years. LAG indicates that the variable was lagged by one year. Significant at 1%(***), 5%(**) and 10% levels(*).

6 Conclusion

This thesis builds on the paper of Yermack (1996) and evaluates the relationship between firm value and board size in the US oil sector between the period 2010 and 2017. Based on empirical and theoretical literature several advantages and disadvantages of a small board of directors have been put forward. The main advantage is that the decision-making process becomes more efficient, and the monitoring abilities strengthen. However, the disadvantage of having smaller boards is that the amount of constructive and valuable advice is less compared to relatively larger boards.

An efficient board is valuable not only for its shareholders, but also for the development of an economic system. As the oil sector has strong social responsibility it is important to investigate the association between board size and firm value. Hence, the main research question of this thesis is to what extent firm value was dependent on the size of the board of directors in the US oil sector. Using OLS and fixed-effects regression models with data between 2010 and 2017 for 213 companies, I find an inverse association between board size and firm value. The association seems to have a convex shape, which suggests that most firm value is lost when boards grow from small to medium. The results prove to be robust to two other variables for firm size that I use.

However, the other three hypotheses do not provide evidence to support my main finding. Financial ratios related to board size, presented insignificant coefficients. The same insignificant resulted out of the other regressions which had CEO turnover and CEO compensation as their dependent variables. Thus, no further conclusions can be made concerning the other three hypotheses.

In this thesis endogeneity might influence the results, which could be fixed by using an instrumental variable, or the difference-in-difference method. For further research, the method constructed by De Andres & Vallelado (2008) might be of interest. Furthermore, the method Yermack (1996) uses to account for any causality issues is also interesting for further research. In addition, the dataset of the second sample is quite small which could have influenced the results of the third and fourth hypotheses. This was the result of limited data availability compared to the first dataset.

Finally, for further research, it can be interesting to look at the differences between the Middle East and the US oil sector. As mentioned in section 2.1 the oil sector in the Middle East consists mostly out of state-owned firms. It could be interesting to see what the effect is of reducing board size in the Middle East and compare these results with the US. The reduction of board size might have less of an effect in the Middle East due to government interference.

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Appendix A

Table AI

Regression coefficient estimates: Robustness check board size and market valuation

	(1)	(2)	(3)	(4)	(5)	(6)
Dependent Variable			*Tobin's Q*			
Constant	10.046	1.683***	1.881***	10.564	4.518***	3.927***
	(6.764)	(0.527)	(0.545)	(7.451)	(0.696)	(0.851)
Ln Board size (LAG)	-3.631	0.051	0.038	-3.884	-0.328*	-0.318*
	(2.809)	(0.268)	(0.265)	(3.651)	(0.191)	(0.169)
Ln Assets (LAG)		-0.061	-0.062		-0.208*	-0.146
		(0.058)	(0.058)		(0.111)	(0.137)
Capital expenditures/Sales (LAG)		0.001	0.007		-0.041***	-0.043***
		(0.009)	(0.010)		(0.008)	(0.009)
Outsiders percentage (LAG)		0.145	0.268		-0.789	-0.522
		(0.539)	(0.526)		(0.537)	(0.496)
ROA (LAG)		0.181	0.363		-0.194*	-0.184*
		(0.230)	(0.344)		(0.108)	(0.108)
Firm fixed effects	No	No	No	Yes	Yes	Yes
Years fixed effects	No	No	Yes	No	No	Yes
R^2	0.001	0.016	0.066	0.000	0.139	0.208
Observations	1470	1470	1470	1470	1470	1470

Notes. Regression coefficient estimates of the association between Tobin's Q and the number of directors on the board. Coefficients appear with standard errors clustered by firm (in parentheses). The sample consists of 1470 annual observations for 213 companies between 2010 and 2017 in the US oil sector. The dependent variable is an estimate of Tobin's Q at the end of each fiscal year. Board size is estimated by using the natural log of the number of directors on the board as reported in annual proxy statements. The ln for assets is a proxy for firm size. The first three columns present OLS estimates, the last three columns present fixed effects estimates. Both models include dummy variables for individual years. Other variables are defined in Table I. LAG indicates that the variable was lagged by one year. Significant at 1%(***), 5%(**) and 10% levels(*).

Table AII

Regression coefficient estimates: Robustness check board size and market valuation

	(1)	(2)	(3)	(4)	(5)	(6)
Dependent Variable			*Tobin's Q*			

Constant	10.046	1.767***	1.974***	10.564	3.722***	3.428***
	(6.764)	(0.532)	(0.549)	(7.451)	(0.633)	(0.632)
Ln Board size (LAG)	-3.631	-0.178	-0.193	-3.884	-0.436**	-0.389**
	(2.809)	(0.221)	(0.211)	(3.651)	(0.201)	(0.176)
Ln Sales (LAG)		-0.002	0.004		-0.091	-0.075
		(0.039)	(0.038)		(0.062)	(0.078)
Capital expenditures/Sales (LAG)		0.009	0.015		-0.089	-0.087
		(0.015)	(0.013)		(0.090)	(0.089)
Outsiders percentage (LAG)		-0.003	0.115		-0.839*	-0.525
		(0.562)	(0.558)		(0.474)	(0.463)
ROA (LAG)		0.137	0.293		-0.321***	-0.332***
		(0.254)	(0.353)		(0.115)	(0.117)
Firm fixed effects	No	No	No	Yes	Yes	Yes
Years fixed effects	No	No	Yes	No	No	Yes
R^2	0.001	0.005	0.056	0.000	0.116	0.192
Observations	1470	1470	1470	1470	1470	1470

Notes. Regression coefficient estimates of the association between Tobin's Q and the number of directors on the board. Coefficients appear with standard errors (in parentheses). The sample consists of 1470 annual observations for 213 companies between 2010 and 2017 in the US oil sector. The dependent variable is an estimate of Tobin's Q at the end of each fiscal year. Board size is estimated by using the natural log of the number of directors on the board as reported in annual proxy statements. The ln of sales is a proxy for firm size. The first three columns present OLS estimates, the last three columns present fixed effects estimates. Standard errors are clustered by firm. Both models include dummy variables for years. Other variables are as defined in Table I. LAG indicates that the variable was lagged by one year. Significant at 1%(***), 5%(**) and 10% levels(*).