Master thesis

- Board size in private firms -

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Foreword

During our thesis work we have received valuable comments from our advisor, Øyvind Bøhren, to whom we are very grateful. We highly appreciate his support and advice through the whole process. Without this help the paper could never have been done.

Furthermore, we wish to thank the Centre of Corporate Governance Research, which has provided all the data.
Abstract

This thesis investigates the determinants of board size in Norwegian private firms. Using a comprehensive sample of 244,543 unique firms from 2000 through 2011. We examine the corporate board size, trends and determinants. Guided by recent theoretical work in general and the empirical work of Linck et al. (2008) in particular, we find that board size increase when the economy is in recession. Another important finding is that female-, family- and employee-elected representatives are influencing the board size positively. The findings also support the hypothesis that firm size affects the board size. The results found in this thesis are consistent with previous research.
1. Introduction

According to Goergen, Manjon and Renneboog (2004), a Corporate Governance system can be defined as the combination of mechanisms, which ensure that the management (the agent) runs the firm for the benefit of one or several stakeholders\(^1\) (principals). Furthermore, Hermalin and Weisbach (2003) emphasize that board composition is endogenous and bound to develop with firm characteristics over time. Additionally, corporate board structure and its impact on firm behavior is one of the most debated issues in corporate governance today. This might be a consequence of the Enron and Worldcom scandals, as well as an increasing trend of research on the determinants of board structure (Linck et al. 2008). Hence, the literature is constantly expanding providing new findings within the field.

Most of the existing literature is based on information from American public firms. Furthermore, previous research on board composition has been dominated by board independence, whilst board size has not been researched to the same extent. This paper will try to provide an extension of the existing research by focusing on what determines the board size in Norwegian private firms. In the following, board size will be defined as the number of directors on the board, including both insiders and outsiders.

Writing this paper we complement and extend the research on the issue in several ways. First, we study the board of directors in Norwegian private firms. It is likely that the Norwegian, non-listed firms will provide different results than the listed U.S. firms. This is based on the large difference in firm size between the two samples, which leads to different needs of governing and external expertise. On average, a Norwegian private firm is much smaller than a public U.S. firm, and that might have an effect on the determinants of board size. In example, the need for external expertise might be less important in a small firm. Furthermore, compared to public firms, private firms differ a lot with regards to size and composition amongst each other as well. The public firms are all ASA firms, while the private firms differ from large ASA firms down to firms with only one

\(^1\) Stakeholder: anyone with an interest in the firm, such as owners, lenders, government, environmental organizations and workforce (Brealey, Myers and Marcus 2012).
employee or board member. Such difference in the structure within the group can have a strong impact on the board structure, and the board size in particular. 

**Secondly**, private firms operate within a different framework than the listed firms. This framework will affect the behavior of the company, such as their governance (Berzins, Bøhren and Rydland 2008). **Thirdly**, the private firms might experience pressure to include family members or other acquaintances to the board even though it is not contributing to optimize the firm value (Eisenberg et al. 1998). This could potentially lead to an increase in board size. **Lastly**, the data being used in this thesis is based on private companies that are not subject to the same regulation as the public companies. If this paper were done on public firms in Norway, the companies would be obliged to follow restrictions with regards to for example the female quota. This is not the case for the private firms, except the few ASA firms, and might provide different results than the existing empirical studies. However, it would be interesting to research whether this regulation has a rub-off effect on the non-listed firms as well. This will be deliberated when the results from the regression is discussed.

The thesis is based on the study “the determinants of board structure” by Linck. et al done in 2008. However, the sample differs quite extensively. We use an exceptionally comprehensive sample, including approximately 244 543 unique companies from 2000 to 2011. The sample consists of companies with differing features with regards to size, age and industries. This makes it possible to generalize the results. The time period is different from what have been used in other papers, which may lead to a different result in itself. For instance, it is likely that the recession will have an impact on the result. Previous research has mainly investigated whether board size has an effect on firm performance. We will research the inverse relationship, which will extend the existing research further.

In Norway, private firms constitute the vast majority of both total number of companies and value creation. In the period 1994-2008, non-listed companies accounted for 99.9 % of the total number of companies in Norway. Additionally, the non-listed firms represented 79 % of the total turnover (Bøhren 2011, 35). The publicly available information about the Norwegian non-listed firms is almost as
good as for the public firms (Berzins and Bøhren 2009). This is in fact quite unusual. In the US, for instance, there is no publicly available information about accounting data, ownership data or board-related data for non-listed firms. This is likely to be the reason for why most of existing research has been focusing on American public firms.

Our model explains 24.2 % of the variation in the size of the board of directors. We find that medium and large sized firms experience a slightly decreasing trend in the number of board members from 2000 until 2008. Then both groups experience an increase the following year, before the trend stabilizes. This indicates that the companies choose to increase the board size in crisis times. Due to the large number of companies with only one board member, the group of small sized firms experience a constant trend during the investigated period of time. Overall, we find family-, employee elected- and female representatives to have a positive impact on the board size. This relationship is found to be statistically significant at the 1%-level.

The paper is structured in the following way: in section 2 and 3 we present existing theory and highlight relevant empirical findings. Section 4 consists of a discussion of characteristics that might affect the board size in Norwegian non-listed firms, and the belonging proxies. After presenting our hypotheses in section 5, we further present the base case regression in section 6. Additionally, we summarize the independent variables that have been discussed, as well as the relevant proxies, in a table. Section 7 describes the data, the sample and how the data is filtered. Moreover, in section 8, descriptive evidence on the development of corporate board size during the time period is provided, as well as the statistical results. In addition, we test our hypotheses regarding the determinants of board size. In section 9 we perform a robustness test, including the problems regarding multicollinearity. Lastly, our concluding remarks are provided in section 10.
2. Theory

In this section we will first try to link the responsibilities of the board of directors to board size. Secondly, we will discuss the independent variables we find interesting when determining board size.

From a legal perspective, the board of directors has the highest authority in a company (Zainal, Zulkifli and Saleh 2013). Their responsibilities can be divided into two different functions, namely monitoring and advising (Adams and Ferreira (2007) and Raheja (2005)). In general, the monitoring function consists of overlooking the management. Monitoring helps the board make sure unwanted and harmful behavior does not occur, one example being fraud. The outsiders are believed to perform this task with the most satisfactory outcome, because they are perceived as more independent than the insiders. However, this function is not contributing to maximizing stockholder wealth, and the outsiders do not have the same knowledge about the firm specific constraints and opportunities as the insiders. When monitoring is high, there tend to be more outsiders. These outsiders have less insight in the firm’s operations, due to the CEO being reluctant to share information, because it may lead to closer monitoring (Adams and Ferreira 2007). This contributes in making the information flow less efficient, hence reducing the advisory function.

Raheja (2005) argues that the board will be smaller when the incentives of the insiders and the shareholders are aligned. This is due to the reduced likelihood of the insiders taking on inferior projects, which in turn reduces the need for outside monitors. Such a reduced need will in turn result in a smaller board of directors.

The advisory function helps the management making good decisions with regards to the company’s strategy and actions, contributing to increase stockholder wealth. According to Raheja (2005), the insiders have knowledge about important firm-specific information, but their objectives are distorted because of private benefits and lack of independence from the CEO.

The optimal board structure is a function of monitoring and advising with regards to costs and benefits given the characteristics of the firms, including other
governance mechanisms. Since there are advantages and disadvantages with both the functions, it is important for the firms to find the optimal amount of monitoring and advising for their company. There is no such thing as a universal optimum, and each company must obtain the most efficient combination of the two for their board.

2.1 Firm size

Firm size is believed to be an independent variable affecting board size. By definition, larger firms are involved in a higher volume of activities compared to smaller firms. Furthermore, it is likely that larger firms are involved in more diverse activities as well (Lehn, Patro and Zhao 2004). This might lead to a higher demand of governing from the board, and therefore a necessity for higher capacity and a larger board of directors. Both Booth and Deli (1996) and Pfeffer (1972) argue that larger firms most likely are dependent on more external relationships, which could require a larger board if the firm prefers to add this competency to the board, rather than replacing it with something else.

2.2 Firm complexity

Coles, Daniel and Naveen (2008) argue that firm complexity affects the board size, and that leverage is related to firm complexity. This is based on the fact that firms with high leverage are more dependent on external resources, in which increases the need for advice. Hence, a larger board is required. 

Linck et al. (2008) argue that the monitoring and advising function is related to the firm complexity, and that firm complexity influences the board size. One example is that complex firms need more expertise in the board, as well as more advising, which would require a larger board of directors. According to Fama and Jensen (1983), the cost of monitoring is increasing, as the company becomes more complex, but the benefits from effective monitoring are believed to outweigh the increasing cost. On the other hand, adding directors contribute with important information and advising, but it also increases the free-rider problem and coordination costs, as well as the direct costs (Linck et al. 2008). Maug (1997) states that it is not optimal for a company with high information asymmetry, to invite monitoring from independent directors, due to the cost of transferring the firm specific information to the outsiders. Moreover, Jensen (1993) argues that it
is costly for larger board of directors to both monitor growth firms and for outsiders to advice. This suggests that the cost of monitoring and advising should lead to a decrease in board size.

Another factor that is assumed to affect firm complexity is the firm age (Boone et al. 2007). The theory suggests that a firm will become more complex as it gets older, hence, require a larger board of directors. However, Linck et al. (2008) question whether this trend will end once the firm reaches the mature phase in the product life cycle. This suggests that the trend is non-linear.

2.3 Board diversity

Another factor that is believed to influence the board size is the degree of board diversity. Board diversity is defined as board members with a varied combination of attributes, such as nationality and gender, in addition to number of employee-elected representatives and family members. Van der Walt and Ingley (2003) divide board diversity into two categories; demographic diversity and cognitive diversity. While the former refers to the observable attributes of the board members, such as gender, age, ethnicity or nationality, the latter relates to the unobservable attributes. Such unobservable characteristics could be education, experience or different organizational membership (Milliken and Martin 1996). In other words, it is possible to affect the cognitive attributes, but not the demographic ones.

The share of female directors in the board is considered to be an important issue with regards to board diversity. According to the definition above, this will belong in the demographic diversity. Even though the majority of the firms in our sample are not obliged to follow the gender quota law, there might be a side effect of the law, rubbing off from the listed firms. They might influence the non-listed firm’s values, and encourage them to increase their share of female board members. There are two ways to increase the female share; either replacing the existing board members or adding new female members to the board. Increasing the board size to include female directors can be associated with a firm’s need to increase board diversity (Farrel and Hersch 2005).
Employee-elected representatives on the board refer to cognitive diversity. Fauver and Fuerst (2006) state that employee directors take on the advisory role when becoming a member of the board. One may argue that they possess information that is useful with regards to the employees. However, they might not have the knowledge that is required to discuss other issues. Thus, one may expect that these employee directors are not replacing existing members, but are simply added to the board. In other words, this would suggest a positive relation between share of employee-elected representatives and board size.

Another attribute that refers to demographic diversity is the share of family members in the board. As mentioned previously, smaller firms might feel pressured to include family members in the board, even though it is not contributing to optimizing value. This might lead to a larger board, because the family members are added to the board, instead of replacing existing members (Eisenberg et al. 1998). One potential explanation for this is that the board cannot afford to lose the existing competency. Another relevant aspect is that board members, with family relations in the board, are likely to behave differently due to the social relation within a family.

2.4 Firm performance

The association between board characteristics and firm performance is a fundamental issue in the corporate governance literature. Most studies look at the relationship between board size and the level of corporate performance. However, we will look at performance as a determinant of board size. On one side, there is reason to believe that a company would increase its board of directors in times of crisis. This is due to the need of more competence in the board to maintain long-term operations. On the other side, companies might have a short-term horizon and an urge to save money instantly instead of investing in the long-run operations. The companies are then likely to reduce the board size in order to maintain a low level of compensations.

The theoretical relationships between board size and the determinants can be summarized in the following way. Board size and firm size are believed to have a positive relationship. This is mainly because larger firms are involved in more
diverse activities, which in turn requires more governing from the board, as well as more external relationships. The theory divides firm complexity into several sub variables, in which three of them are discussed in this thesis. Both leverage and firm age are believed to increase firm complexity, which in turn increases the board size. Inversely, theory suggests that the cost of monitoring and advising should lead to a decrease in board size. Theory further suggests a positive relation between board size and the number of female-, employee- and family representatives on the board. This is due to the expectations of the respective representatives are added to the board, instead of replacing existing board members. Regarding the relationship between board size and firm performance, it seems to be somewhat diverse, due to short-term versus long-term thinking. Theory suggests a positive relationship if having a short-term horizon and vice versa.

3. Empirical research

This section will discuss the independent variables found relevant when determining the size of the board of directors. The discussion will be based on previous research.

3.1 Firm size

Lehn, Patro and Zhao (2004) documented a positive, significant relationship between firm size and board size. They studied 81 publicly traded U.S. firms over a period from 1935 to 2000 using panel data and five-year intervals. Furthermore, this relationship was also tested and confirmed by Boone et al. (2007). They used a sample that included all industrial firms that undertook an IPO in the U.S. market, from 1988 to 1992.

3.2 Firm complexity

Lincck et al. (2008) used a sample of almost 7000 firms over a period from 1990 to 2004, and found board size and leverage to be positively and significantly related. This supported their hypothesis, which suggested board size to increase with firm complexity. Furthermore, they found some support for board size decreasing in monitoring and advising costs, as well as firms with high growth opportunities to be associated with smaller board of directors. The study done by Lehn, Patro and
Zhao (2004), which is mentioned in section 3.1, also find that board size is negatively related to growth opportunities. This was in accordance with their expectations.

Boone et al. (2007) found that firm complexity increases with the age of the firm. However, as mentioned in section 3.1 Boone et al. (2007) used IPOs in their study. Based on this fact, Linck et al. (2008) questioned whether firm complexity would increase with firm age, once the firm reaches the mature phase in the product life cycle. To test for this they included firm age and the squared of the firm age in their regression. They found firm age to be positively and significantly related to board size, which again supported their hypothesis. Furthermore, they found the square of the firm age to have a negative coefficient. This was as predicted as well, suggesting that the impact of firm age on board size increases at a decreasing rate. In other words, they found that firm complexity is not likely to increase at the same rate for young firms as for mature firms (Linck et al. 2008).

3.3 Board diversity

Ahern and Dittmar (2012) studied 248 publicly listed Norwegian firms, in the period from 2001 to 2009. They primarily studied the impact on firm valuation of mandated female representatives. Their sub results suggest that firms replace existing board members to comply with the law, instead of adding them. By law they refer to the gender quota law and the mandatory share of employee-elected directors, for companies with 200 employees or more.

3.4 Firm performance

Both Pearce and Zahra (1992) and D'Aveni (1990) have studied the relationship between the level of corporate performance and board size. These studies find that an increase in prior year firm’s performance will reduce the size of the board of directors. Conversely, Yermack (1996) find that a decline in prior year firm’s performance will reduce the size of the board of directors in coming years. This is due to the expectations of the outside directors being removed from the board, partly because of their high compensations.

Based on this section the empirical relationships between board size and the determinants can be summarized as follows: Lehn, Patro and Zhao (2004) and
Boone et al. (2007) have tested the relation between board size and firm size, and documented a positive relationship, which is in accordance with the theory section. Linck et al. (2008) find board size and leverage to be positively and significantly related, which in turn suggests board size to increase in firm complexity. Moreover, Lehn, Patro and Zhao (2004) and Linck et al. (2008) find board size to be negatively related to the monitoring and advising costs and hence, growth opportunities. Also, Linck et al. (2008) find board size to be positively and significantly related to firm age, which is in accordance with the theory section. Regarding the relationship between board size and the number of female-, employee- and family representatives, the empirics do not support the theory. Ahern and Dittmar (2012) find that companies are replacing existing board members to comply with the law, instead of adding them. In other words, they find board size to be unchanged.

4. Proxies

Based on the theory - and empirics section, different variables have been developed to proxy for the independent variables. These will be applied in the regression that is presented in section 6. If there are two proxies for the same independent variable or sub variable, one will be used in the base case regression, while the other will be included in the robustness test.

4.1 Firm size

Yearly Sales gives an indication about the size of a company. Another good indicator can be the Book value of Assets. However, our sample consists of different sectors, where large differences in value of assets are likely. An example of this can be a firm that operates in the shipping industry, whilst another firm operates within the software industry. Therefore, to proxy for firm size, yearly sales will be applied in the base case regression, while book value of assets will be used when performing the robustness test.

4.2 Firm complexity

A commonly used measure to proxy for information asymmetry, and the costs of monitoring and advising, is the standard deviation of stock returns (Linck et al. 2008). However, this is just available for listed firms. Following Linck et al.
(2008), we will therefore use the level of R&D expenditures to proxy for monitoring and advising costs instead. This is a standard proxy for growth opportunities, and as mentioned in the theory section, monitoring and advising costs are related to a firm’s growth opportunities.

Based on the theoretical and empirical research, capital structure is believed to explain firm complexity. Proportion of debt is considered to be a good proxy for firm complexity (Linck et al. 2008) and hence, Debt/Total Assets will proxy for the capital structure. This ratio gives an indication of how the financial burden is distributed within the company.

Furthermore, we include the natural logarithm of firm age. This is due to the fact that a company’s position in the product life cycle is assumed to affect the firm complexity. Therefore, \( \ln \text{Firm Age} \) is included in the base case regression. However, it is not clear that the relation between influence of age and firm complexity is a linear trend, which will continue when the firm enters the mature phase in the product life cycle. To take this into consideration \( \text{Firm Age}^2 \) will be included in the robustness test.

4.3 Board diversity
To measure the share of family-, female- and employee-elected members in the board, we originally wanted to make intervals. Doing this the numbers would have been reduced to the ordinal level. In order to make the numbers as accurate as possible, we have therefore chosen to use the number of family-, female- and employee-elected directors itself. In other words, we have kept the cardinal numbers. The proxies for board diversity that is included in the base case regression is named \( \text{FAM}, \text{FEM} \) and \( \text{EMP} \).

4.4 Firm performance
Annual ROA provides an indication of how profitable a company is relative to its total assets. In other words, it reflects a company’s operating performance. However, it has been debated whether ROA is a correct proxy for firm performance. Some of the critique involves the fact that ROA is a measure that is possible to manipulate, through for instance earnings management. Even though
ROA has some short comings, these are believed to be outweighed by the advantages. Hence, ROA is used as our performance measure, which is in accordance to Mehran (1995).

5. Hypothesis

Based on the previous sections, we see that several factors are believed to influence the size of the board of directors. The hypotheses are based on these factors, and are stated below. Additionally, expectations regarding the relation between board size and the different independent variables/sub variables are included.

5.1 Firm size

Firm size is believed to affect the size of the board of directors. Based on the arguments in the theory- and empirics sections, we presume a positive correlation between sales and board size, as well as book value of assets and board size.

Hypothesis 1: firm size will increase the size of the board of directors.

5.2 Firm complexity

Leverage is expected to have a positive relation with firm complexity, meaning that a complex firm is likely to have a larger proportion of debt in their capital structure. We presume that this will contribute to increase the board size.

Furthermore, we presume R&D to have a negative coefficient. Based on the theory section, we expect a firm’s growth opportunities to have a negative relation with the cost of monitoring and advising. This is further expected to affect the board size negatively.

Finally, we expect firm age to have a positive coefficient, meaning that we expect firm complexity to increase with firm age. However, we presume the square of firm age to have a negative coefficient. This is because we find it unlikely that firm complexity will increase at the same rate as the company develops through the product life cycle.
Leverage and firm age are expected to increase the board complexity, while R&D expenditures are expected to have a decreasing effect. We believe that leverage and firm age will affect the board complexity in a stronger manner than R&D. In other words, we expect board complexity to affect the board size positively.

**Hypothesis 2:** firm complexity will increase the number of board of directors.

### 5.3 Board diversity

Furthermore, the degree of board diversity might influence the board size. As mentioned in section 2.3, we chose to include the number of employee-elected-, female- and family representatives in the board. Regarding the number of employee-elected directors, we presume a positive correlation with board size. Based on the theory section, we also presume a positive relation between both the number of female- and family representatives and the number of board of directors.

**Hypothesis 3:** board diversity will increase the number of board of directors.

### 5.4 Firm performance

Moreover it is expected that there is a relationship between firm performance and board size. Based on the theory- and empirics section we expect a negative relationship between a firm’s performance and board size in current year.

**Hypothesis 4:** firm performance will decrease the size of the board of directors.

### 6. Regression model and overview of variables

In this section the base case regression line will be stated, followed by the independent variables and their corresponding hypothesis. In the base case there will be one proxy per characteristic. The remaining proxies will be applied when performing a robustness test. When referring to the base case regression line later in the thesis it will be called Equation 1.
6.1 Independent variables

Below is an overview of the discussion, where the independent variables, as well as the belonging hypothesis can be found. Furthermore, all the proxies are summed up in a table. These are the proxies that are considered the most fitting to describe the four independent variables.

Table 1: Independent variables, their proxies and expectations.

<table>
<thead>
<tr>
<th>Theoretical variable</th>
<th>Empirical variable</th>
<th>Prediction</th>
<th>Name in regression</th>
<th>Base Case / Robustness</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Firm size</strong></td>
<td>Sales in NOK in real terms + Sales in NOK in real terms</td>
<td>+</td>
<td>Sales</td>
<td>Base case regression</td>
</tr>
<tr>
<td></td>
<td>Book value of assets last fiscal year + BV_Assets</td>
<td>+</td>
<td>BV_Assets</td>
<td>Robustness test</td>
</tr>
<tr>
<td><strong>Firm complexity</strong></td>
<td>Capital structure Long-term debt / Total assets</td>
<td>+</td>
<td>Debt</td>
<td>Base case regression</td>
</tr>
<tr>
<td></td>
<td>Monitoring and advising costs R&amp;D expenditures / Total assets</td>
<td>-</td>
<td>R&amp;D</td>
<td>Base case regression</td>
</tr>
<tr>
<td></td>
<td>Place in product life cycle Firm age Ln</td>
<td>+</td>
<td>FirmAge Ln</td>
<td>Base case regression</td>
</tr>
<tr>
<td></td>
<td>Place in product life cycle Firm age^2, to test for non-linearship</td>
<td>-</td>
<td>FirmAge^2</td>
<td>Robustness test</td>
</tr>
<tr>
<td><strong>Board diversity</strong></td>
<td>Number of family members in the board Largest family's number of board members</td>
<td>+</td>
<td>FAM</td>
<td>Base case regression</td>
</tr>
<tr>
<td></td>
<td>Number of women in the board Female board members</td>
<td>+</td>
<td>FEM</td>
<td>Base case regression</td>
</tr>
<tr>
<td></td>
<td>Number of employee-elected members in the board Employee elected board members</td>
<td>+</td>
<td>EMP</td>
<td>Base case regression</td>
</tr>
<tr>
<td><strong>Firm performance</strong></td>
<td>Return on assets (ROA)</td>
<td>+</td>
<td>ROA</td>
<td>Base case regression</td>
</tr>
</tbody>
</table>

6.2 Regression

From the previous sections the following base case regression is developed:

\[
\text{Board size} = \alpha + \beta_1 \text{Sales}_{it} + \beta_2 \text{Debt}_{it} + \beta_3 \text{R&D}_{it} + \beta_4 \text{lnFirmAge}_{it} + \beta_5 \text{FAM}_{it} + \beta_6 \text{FEM}_{it} + \beta_7 \text{EMP}_{it} + \beta_8 \text{ROA}_{it} + \epsilon_{it} \tag{1}
\]
7. Data and descriptive statistics

To test for the predictions, we examine the relation between board size and the independent variables (Appendix 1).

7.1 Data

The data being used is provided by the CCGR database at BI Norwegian Business School. This consists of Norwegian private firms and contains, among others, firm-specific financial statements data and detailed information about the identity of board members and top executives (Abdolmohammedi et al. 2010). Further, it is a very accurate database with cleaner numbers than found in other countries. This is due to the Norwegian law, which imposes all AS and ASA companies to report their annual accounts by the same template (Bøhren 2011, 34). While most of the data in the CCGR database goes back to 1994, some is only provided from 2000. Thus, the sample period is set to be from 2000 through 2011. The tables Account_Data, Misc_2000, Industry_Code, Ownership_Control and Family have been applied.

7.2 Data filtering

First, we began with deleting all lines where board size was either zero or not available, in order to have a valid number on the left hand side of the regression. Furthermore, we deleted all lines where fixed assets and current assets equaled zero, due to three of our independent variables are divided by total assets. All observations where company age was zero, or not available, were removed from the dataset as well. Additionally, we deleted all companies that had a different fiscal year ending 31.12.20XX. Finally, we included firms with a minimum of three observations.

7.3 Sample

Table 2: sample selection

This table reports the number of observations every year throughout the sample. The dataset provided by CCGR was originally more than three million observations from 1994-2011. The data from 1994-1999 was deleted, since this was outside the chosen time period. The sample was then restricted to firms that provided information regarding board size, as well as total assets. The sample was also restricted to companies providing company age and having a
fiscal year ending 31.12.XX. Additionally, companies with at least three observations over the time period were included.

<table>
<thead>
<tr>
<th>Year</th>
<th>N</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>2000</td>
<td>65 016</td>
<td>4.34 %</td>
</tr>
<tr>
<td>2001</td>
<td>73 714</td>
<td>4.92 %</td>
</tr>
<tr>
<td>2002</td>
<td>74 435</td>
<td>4.96 %</td>
</tr>
<tr>
<td>2003</td>
<td>68 775</td>
<td>4.59 %</td>
</tr>
<tr>
<td>2004</td>
<td>96 924</td>
<td>6.46 %</td>
</tr>
<tr>
<td>2005</td>
<td>105 532</td>
<td>7.04 %</td>
</tr>
<tr>
<td>2006</td>
<td>130 039</td>
<td>8.67 %</td>
</tr>
<tr>
<td>2007</td>
<td>139 931</td>
<td>9.33 %</td>
</tr>
<tr>
<td>2008</td>
<td>173 582</td>
<td>11.58 %</td>
</tr>
<tr>
<td>2009</td>
<td>181 504</td>
<td>12.11 %</td>
</tr>
<tr>
<td>2010</td>
<td>178 499</td>
<td>11.91 %</td>
</tr>
<tr>
<td>2011</td>
<td>203 753</td>
<td>13.59 %</td>
</tr>
<tr>
<td>Total</td>
<td>1 499 255</td>
<td>100 %</td>
</tr>
<tr>
<td></td>
<td>Total unique firms</td>
<td>244 543</td>
</tr>
</tbody>
</table>

Table 2 reports the time series of the sample. It includes almost 1.5 million observations on approximately 245 000 unique firms. This gives an average of 6.1 observations for every unique firm over the twelve year period.
Table 3: Descriptive statistics

The table reports mean and median of the independent variables affecting board size. The sample includes 244,543 unique firms and 1,491,704 firm years over the period 2000-2011. The data included in the set has a fiscal year ending 31.12.20XX. The data is provided from the CCGR database at BI. Employee-elected is the number of board members elected among the employees in the firm. Family is the number of family representatives in the board, Female is the amount of female board members, InFirm Age is how many years it is since the firm was founded and then used the natural logarithm, Long-term Debt/Total Assets is capital structure, ROA measures the return on assets, R&D/Total Assets measures the potential growth in the company and Sales(NOK) measures the firm size in NOK.

<table>
<thead>
<tr>
<th>Variable</th>
<th>Mean</th>
<th>Median</th>
</tr>
</thead>
<tbody>
<tr>
<td>Employee elected</td>
<td>0.0158</td>
<td>0</td>
</tr>
<tr>
<td>Family</td>
<td>1.0910</td>
<td>1</td>
</tr>
<tr>
<td>Female</td>
<td>0.4046</td>
<td>0</td>
</tr>
<tr>
<td>Firm Age ln</td>
<td>1.9308</td>
<td>1.9459</td>
</tr>
<tr>
<td>Long term debt / total assets</td>
<td>1.7215</td>
<td>0.0114</td>
</tr>
<tr>
<td>ROA</td>
<td>-0.0876</td>
<td>0</td>
</tr>
<tr>
<td>R&amp;D / total assets</td>
<td>-0.0936</td>
<td>0</td>
</tr>
<tr>
<td>Sales (NOK)</td>
<td>14 227 150</td>
<td>1 041 000</td>
</tr>
</tbody>
</table>

Table 3 presents the descriptive statistics for the independent variables on the sample as a whole. The employee elected representatives have a mean value (median) of 0.0158 (0), family a mean (median) of 1.0910 (1) and female a mean (median) of 0.4046 (0). The median is 0 for both employee-elected and female representatives due to the large amount of firms not having any employees or females in the firm’s board. Family is represented with one member on average. The firm age (Appendix 2) in the sample is approximately 10 years (7), which is in accordance with Linck et al. (2008) that have a mean (median) of 13 (8). However, Lehn, Patro and Zhao (2004) have a mean firm age of 65 in their sample and Boone et al. (2007) a sample with a mean firm age of 5 years. Long-term Debt/Total Assets has a mean of 1.7215 and a median of 0.0114, which suggests that there are extreme values in the dataset. ROA has a negative mean of -0.0876 and a median of 0 also indicating that there are extreme values in the dataset. This raises outlier concerns, but the large sample is believed to mitigate these problems.
An overview of the number of board members will give an indication on how the number of board members are distributed within the sample.

**Figure 1: Frequency of number of board members**

Figure 1 provides an overview of the distribution of board size in the sample (Appendix 3). Approximately 45% of the boards consist of one member, resulting in a right skewness. One to five members are the most frequent amount of board members cumulating a total of 97.4%, and less than 0.0013% has 12 or more members combined.
Table 4: Determinants of board size

The table reports an overview over the statistics of board size divided into groups depending on size. The groups small, medium and large are determined by board size. The small group is made up by the first quintile, which only contains firms with one board member. The medium group is quintile two through four, and consists of one to three board members. The large group consists of the last quintile, which contains three to fifteen board members.

<table>
<thead>
<tr>
<th>Variable</th>
<th>Small</th>
<th>Medium</th>
<th>Large</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean</td>
<td>Median</td>
<td>Mean</td>
</tr>
<tr>
<td>Employee elected</td>
<td>-</td>
<td>-</td>
<td>0.0009</td>
</tr>
<tr>
<td>Family</td>
<td>0.8855</td>
<td>1</td>
<td>1.1180</td>
</tr>
<tr>
<td>Female</td>
<td>0.1063</td>
<td>0</td>
<td>0.3547</td>
</tr>
<tr>
<td>Firm Age</td>
<td>13.6541</td>
<td>13</td>
<td>8.5458</td>
</tr>
<tr>
<td>Long Term Debt/Total Assets</td>
<td>2.3059</td>
<td>0</td>
<td>1.8010</td>
</tr>
<tr>
<td>ROA</td>
<td>-0.6397</td>
<td>0</td>
<td>0.1860</td>
</tr>
<tr>
<td>R&amp;D/Total Assets</td>
<td>-0.0714</td>
<td>0</td>
<td>-0.1136</td>
</tr>
<tr>
<td>Sales (NOK)</td>
<td>4 402 624</td>
<td>900 000</td>
<td>7 347 116</td>
</tr>
</tbody>
</table>

Table 4 reports the summary statistics grouped by board size. The groupings are based on the number of board members. The sample is divided into quintiles, and the small group consists of the first quintile. The medium group is quintile two through four and the large group is made up by the fifth quintile. There are several reasons why such a grouping is interesting. First of all there tend to be a higher focus on the large firms, resulting in neglecting the smaller firms. Second, this is a way of ensuring the robustness of our model, because we are able to see how outliers affect the groups as well as differences between the groups. Due to problems with collinearity, employee elected had to be excluded from this analysis for the small group. This is due to the fact that quintile one only consists of firms with one board member, and employee elected consistently zero. One way to remove the problem of this kind of collinearity is to remove the variable (Brooks 2008).

There are some interesting differences between the groups, such as the large group has a much higher share of employee elected board members than the medium group (0.0782 vs. 0.0009). This is in accordance with our expectations because of
the law stating that firms with more than 200 employees are obliged to have employees as part of the board. Another notable difference is how high the female share is in the medium (0.3547 women) and large (0.8716 women) group compared to the small group (0.1063 women). This indicates that women are less likely to own their own firm, and be the only board member. Additionally, Sales (NOK) are deviating quite a lot between the groups. The small and medium groups have a mean of approximately 4.4 million and 7.3 million, respectively. The median of these two are almost identical with 900 000 and 899 000. On the other hand, the large group has a mean (45 million) and median (2.2 million), indicating large differences, not just between the quintiles, but also inside the fifth quintile. The first four quintiles are quite normal, and do not indicate large amounts of extreme values. However, the fifth quintile seems to contain more extreme values given the large deviation in number of board members and sales. As mentioned earlier, the large sample is believed to mitigate these problems.

8. Results and analysis

8.1 The trend in board size from 2000 through 2011

Using our dataset, we wanted to provide descriptive evidence on the development of board size from 2000 to 2011. Furthermore, we wanted to investigate whether an increase in board size might have caused any differences in the number of family-, employee elected- or female members in the board. The results are summarized in the following four graphs.
Figure 2: Board structure trends: 2000-2011.
The sample includes 244,543 unique firms covering 1,491,704 observations over the period 2000-2011. We have formed the size groups by ranking the companies into quintiles, based on the board size. The first quintile is labeled small, quintile two through four is labeled medium, while the last quintile is labeled large. The mean (median) board size for small, medium and large companies is 1 (1), 1.9646 (2) and 4.3991 (4), respectively. In order to make the graphs as intuitive as possible we have chosen to use the share of the respective representatives to board size. Panel A reports the average board size, panel B reports the share of women in the board, panel C reports the share of employee-elected in the board, and panel D reports the share of family-elected in the board.
From Figure 2 we see the time trends of board size, as well as the percentage share of female-, employee-elected- and family representatives in the board, from 2000 through 2011. Panel A reports the former. Due to the high number of companies with only one board member in our sample, the first quintile – small – consist of a 100 % constant trend at one board member. Further, panel A reports a slightly decreasing trend in board size for the medium and large group until 2008. Then both groups experience an increase the following year, before the trend stabilizes. This is consistent with the hypothesis that firms need closer governing in times of crisis.

Panel B shows an overall increasing trend in the share of female members on the board. The groups of small and medium experience a somewhat steady increase throughout the sample period, while the large group has a more fluctuating trend. In total, the large group experiences the largest increase in share of women, as it increased from 14.6 % in 2000 to approximately 25.6 % in 2011. Simultaneously, the board size (Panel A) declined slightly during the same period for both medium and large firms, while at a constant level for the small group. This can be seen as an indication that females are replacing existing male board members, which is inconsistent with hypothesis 3; that females are added to the board instead of replacing existing members.

In 2004, the share of female representatives in the boards increased from 14.4 % to 17.4 % in the large group, before it declined the year after. In 2006 the same group experienced an increase once more, from an average share of 16.4 % to 19.3 %. This could be an indication of a rub off-effect from the Norwegian female gender quota law. In 2003 the Norwegian Parliament passed a law on gender balance in boards, in public limited companies. The law entered into force on January 1st 2006 (regjeringen.no), which seems to correlate with the behavior of the graph. The female quota law does not apply to the private companies in Norway, but this gives an indication of a rub off effect. There are some ASA firms in our sample that are bound by this law, and there is a possibility that these companies affect the number of female board members. However, the large sample is believed to reduce the affect from these companies, and a rub off effect seems likely.
Panel C illustrates the trend in average share of employee-elected representatives in the board. The small group does not have any employee-elected members because it only consists of one board member. The average share of employee-elected members remains stable for the medium group. Comparing this to findings in Panel A, we find that the employee-elected representatives are replacing the existing board members in the medium group. This is inconsistent with the expectations and hypothesis 3. The large group experiences a different trend. The number of employee-elected is fluctuating, and overall decreasing. Compared to the findings in panel A, the employee-elected representatives are removed when the board size is reduced. This indicates a positive correlation between board size and employee-elected representatives, which is consistent with hypothesis 3.

Panel D illustrates the average share of family representatives in the board. All three groups show a stable trend until 2007, where all groups experience a decline. Both small and medium groups increase in 2008, before they decrease slightly again the year after and then fairly stabilizes. The decline in the large group continues throughout the sample period. Further, panel D reports that the share of family representatives are largest in the companies that have a small board of directors. This indicates that a large number of the companies in the sample are established for investment purposes only. Comparing panel D to panel A it seems that the family representatives is replacing the existing board members, which is not in accordance with hypothesis 3 and our expectations.

8.2 Fixed effects

When running the regression, the statistical software EViews was used. To be able to deal with both cross-sectional data and time, panel data was applied as it is able to deal with such problems (Brooks 2008). Panel data makes it possible to tackle more complex problems than with pure time-series or cross-sectional data.

To ensure using the correct model, a Hausman test was performed (Appendix 4). This test gives an indication to whether fixed effect or random effect is the most applicable. Due to the large sample, the fixed effect model is considered to be the most applicable, but to ensure the models correctness the test was performed. $H_0$ was rejected at the 1 % significance level, meaning that the random effects model
was not consistent or efficient. The fixed effects model was therefore applied. This model says that we are interested in the variation within the firms, and the fixed effect model form the population in which we want to conclude upon (Brooks 2008).

8.3 Statistical results

Table 5: Determinants of board size

The table reports the prediction of the coefficient sign based on the hypothesis, the coefficient from the regression as well as the p-value. The table reports the results from the regression line performed on board size. The sample used in this regression includes observations from 2000-2011. The regression is based on least squares, with fixed panel data in EViews. 

Employee-elected is the number of employee elected members in the board. Family is the number of family representatives in the board, Female is the number of female board members, lnFirm Age is the natural logarithm on how long it is since the firm was founded. Long-term Debt/Total Assets is a measure of the capital structure, ROA is a measure of firm performance, R&D/Total Assets measure the R&D expenses relative to total assets. Sales (NOK) is a measure of the firm size. N is the total panel observations, Model p-value is the p-value for the model seen as a whole and $R^2$ measures the goodness of fit for the model compared to the data.

<table>
<thead>
<tr>
<th>Variable</th>
<th>Prediction</th>
<th>Coefficient (p-value)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Employee elected</td>
<td>+</td>
<td>1.5365*** (&lt;0.001)</td>
</tr>
<tr>
<td>Family</td>
<td>+</td>
<td>0.0037*** (&lt;0.001)</td>
</tr>
<tr>
<td>Female</td>
<td>+</td>
<td>0.8114*** (&lt;0.001)</td>
</tr>
<tr>
<td>Firm Age (LN)</td>
<td>+</td>
<td>0.0575*** (&lt;0.001)</td>
</tr>
<tr>
<td>Longterm debt / total assets</td>
<td>+</td>
<td>-1.01E-05 (0.0574)</td>
</tr>
<tr>
<td>ROA</td>
<td>+</td>
<td>2.40E-07 (0.9528)</td>
</tr>
<tr>
<td>R&amp;D / total assets</td>
<td>-</td>
<td>-6.45E-05 (0.2994)</td>
</tr>
<tr>
<td>Sales (NOK)</td>
<td>+</td>
<td>3.40E-11*** (&lt;0.001)</td>
</tr>
<tr>
<td>N</td>
<td></td>
<td>1 491 704</td>
</tr>
<tr>
<td>Model p-value</td>
<td></td>
<td>(&lt;0.001)</td>
</tr>
<tr>
<td>R squared</td>
<td></td>
<td>0.2433</td>
</tr>
<tr>
<td>Adjusted R-squared</td>
<td></td>
<td>0.2432</td>
</tr>
</tbody>
</table>

* . ** . *** denote the significance level at the 10% 5% and 1% level respectively.
Table 5 reports the results from Equation 1. The employee-elected-, family- and female-representatives are all significant with a positive impact on board size. This is in accordance with our expectations, indicating that they are added to the board instead of replacing existing board members. InFirm Age is positive and significant indicating that firms increase the board size as they get older. Long-term Debt/Total Assets is negatively related to board size, which is inconsistent with our hypothesis. Nevertheless, it is not statistically significant. R&D/Total Assets are negatively correlated with board size, but are not statistically significant. This is in accordance with our predictions, and does support the hypothesis that board size should decrease in monitoring and advising costs. ROA is positive, which is in accordance with our expectations. However, it is not statistically significant. Sales are significant and positively related to board size, which is in accordance with our hypothesis, that board size increase with firm size. The model is based on 1 491 704 observations and is significant at the 1% level. The model explains 24.33 % of the variation in board size, which is a significant amount of variation.

9. Robustness test

This section consists of additional tests, performed to deal with econometric and economic concerns. The robustness test consists of two different parts. In the first part, some of the proxies will be replaced, and to see if the results are affected by the time period, the regression is also run with one period lagged. In the second part, the regression from Equation 1 will be run based on the quintiles.

In the beginning of the process, we were thinking of taking female, employee and family share as a share of board size. This turned out to be difficult, because we would then have the dependent variable, board size, at both sides of the regression. Additionally, by keeping the numbers as we did they were kept at the ordinal level, not reducing any information.

The literature use different variables to proxy for different determinants. That gives reason to believe that there exist variables explaining the same determinants, with other proxies. In order to test whether our results are sensitive to the applied proxies, we test the model by changing two of the proxies in Equation 1. To test
the robustness of our results Book Value of Assets and Firm Age\(^2\) will replace Sales and InFirm Age, respectively (Appendix 5). Firm Age\(^2\) checks for non-linearity, and it also provides an indication as to whether firm size and firm complexity are easily affected by the proxies.

### 9.1 Robustness variables and time

Table 6 – robustness check with one period lagged and different determinants

The table reports the prediction of the coefficient sign based on the hypothesis, the coefficient from the regression as well as the p-value. The table reports results from the regression line performed on board size. The sample includes observations from 2000-2011. The regression is based on least squares, with fixed panel data in EViews. Employee-elected is the number of employee elected members in the board. Family is the number of family representatives in the board, Female is the number of female board members, Firm Age\(^2\) is the natural logarithm on how long it is since the firm was founded. Long-term Debt/Total Assets is a measure of the capital structure, ROA is a measure of firm performance, R&D/Total Assets measure the R&D expenses relative to total assets. Sales (NOK) is a measure of the firm size. Firm Age\(^2\) is the firm age squared to check for linearity, Total Assets measure the size of the firm, N is the total panel observations, Model p-value is the p-value for the model seen as a whole and \(R^2\) measures the goodness of fit for the model compared to the data.

<table>
<thead>
<tr>
<th>Variable</th>
<th>Prediction</th>
<th>Coefficient (p-value)</th>
<th>Coefficient (p-value)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Employee-elected</td>
<td>+</td>
<td>1.5666*** (&lt;0.0001)</td>
<td>1.5494*** (&lt;0.001)</td>
</tr>
<tr>
<td>Family</td>
<td>+</td>
<td>0.0040*** (&lt;0.001)</td>
<td>0.0039*** (&lt;0.001)</td>
</tr>
<tr>
<td>Female</td>
<td>+</td>
<td>0.7756*** (&lt;0.001)</td>
<td>0.8183*** (&lt;0.001)</td>
</tr>
<tr>
<td>Firm Age (LN)</td>
<td>+</td>
<td>0.0229*** (&lt;0.001)</td>
<td>0.0229*** (&lt;0.001)</td>
</tr>
<tr>
<td>Long-term Debt / Total Assets</td>
<td>+</td>
<td>-8.14E-06 (0.3558)</td>
<td>-1.59E-05** (0.0171)</td>
</tr>
<tr>
<td>ROA</td>
<td>+</td>
<td>7.43E-07 (0.9111)</td>
<td>-2.02E-06 (0.2265)</td>
</tr>
<tr>
<td>R&amp;D / Total Assets</td>
<td>+</td>
<td>-5.76E-05 (0.3532)</td>
<td>-6.08E-05 (0.3277)</td>
</tr>
<tr>
<td>Sales (NOK)</td>
<td>+</td>
<td>1.06E-10*** (&lt;0.0001)</td>
<td>1.33E-10* (0.0620)</td>
</tr>
<tr>
<td>Firm Age(^2)</td>
<td>+</td>
<td>1.33E-10* (0.0620)</td>
<td></td>
</tr>
<tr>
<td>Total Assets</td>
<td>+</td>
<td>1.75E-11*** (&lt;0.0001)</td>
<td></td>
</tr>
<tr>
<td>N</td>
<td>1 109 100</td>
<td>1.384 677</td>
<td></td>
</tr>
<tr>
<td>Model p-value</td>
<td>(&lt;0.001)</td>
<td>0.2153</td>
<td>0.2417</td>
</tr>
<tr>
<td>R squared</td>
<td></td>
<td>0.2153</td>
<td>0.2417</td>
</tr>
</tbody>
</table>

\*, **, *** denote the significance level at the 10% 5% and 1% level, respectively.
In Table 6, the results for the one period lagged regression are quite similar to the ones found in Table 5. The results found support the findings in Table 5. Looking at the robustness variables, firm age squared were expected to have a negative sign. It is significant at the 10% level, and does not support the hypothesis that the firm complexity is reduced when the firm gets older. Total assets is statistically significant at the 1% level, and supports the findings in Table 5. ROA changes from a positive to a negative coefficient, but it is still statistically insignificant. The R-squared is reduced for the lagged version, while it remains almost the same for the robustness variables.

9.2 Size determined regression and robustness variables

Table 7 – regression line grouped in small, medium and large groups after board size

The table reports an overview over the statistics of board size divided into groups depending on size. The groups small, medium and large are determined by board size. The small group is made up by the first quintile, which only contains firms with one board member. The medium group is quintile two through four, and consists of one to three board members. The large group consists of the last quintile, which contains three to fifteen board members.

<table>
<thead>
<tr>
<th>Variable</th>
<th>Exp sign</th>
<th>Small</th>
<th>Medium</th>
<th>Large</th>
</tr>
</thead>
<tbody>
<tr>
<td>Employee elected</td>
<td>+</td>
<td>-5.60E-17*** (&lt;0.0001)</td>
<td>0.0029*** (&lt;0.0001)</td>
<td>-0.1108*** (&lt;0.0001)</td>
</tr>
<tr>
<td>Family elected</td>
<td>+</td>
<td>-2.88E-16*** (&lt;0.0001)</td>
<td>0.4510*** (&lt;0.0001)</td>
<td>0.2787*** (&lt;0.0001)</td>
</tr>
<tr>
<td>Female</td>
<td>+</td>
<td>-3.00E-17*** (&lt;0.0001)</td>
<td>0.0018*** (&lt;0.0001)</td>
<td>0.0167*** (&lt;0.0001)</td>
</tr>
<tr>
<td>Firm age</td>
<td>+</td>
<td>-6.16E-20*** (&lt;0.0001)</td>
<td>-0.0001*** (&lt;0.0001)</td>
<td>-3.29E-05 (&lt;0.0001)</td>
</tr>
<tr>
<td>Long-term debt</td>
<td>+</td>
<td>-3.78E-20*** (&lt;0.0001)</td>
<td>-0.0009*** (&lt;0.0001)</td>
<td>5.699E-05 (0.5341)</td>
</tr>
<tr>
<td>ROA</td>
<td>+</td>
<td>3.05E-20 (&lt;0.0001)</td>
<td>-8.08E-05 (0.1862)</td>
<td>7.39E-06 (0.9639)</td>
</tr>
<tr>
<td>R&amp;D</td>
<td>-</td>
<td>(0.2890)</td>
<td>(0.1014)</td>
<td>(0.9639)</td>
</tr>
<tr>
<td>Sales</td>
<td>+</td>
<td>-3.96E-24*** (&lt;0.0001)</td>
<td>4.02E-10*** (&lt;0.0001)</td>
<td>1.71E-11 (&lt;0.0001)</td>
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</tbody>
</table>

The small quintile excludes employee-elected because of the problem with only one board member in this group. Family and female are still significant, however
with a negative sign. This does not support the findings in the main regression.
Employee-elected, family-elected and female are all statistically significant, and
with a positive sign for medium and large, except for family elected in the large
group. These numbers support the findings in the main regression. Firm age is
negative for the small group, which does not support our hypothesis. However, it
is positive and statistically significant for medium and large, which supports are
findings. Long-term debt and ROA is statistically significant for small and
medium, but the impact on board size is minimal. R&D supports the previous
findings. Sales are negative and not statistically significant in the small group, but
positive and significant in the medium group. Large is now statistically
insignificant, but positive. The medium results support our findings.

After performing different tests to check for the robustness of our model, it is
clear that especially employee-elected, female and family representatives affects
the board size. These results are robust to changes, and show the same tendency
throughout the tests. Overall the model is robust, and the overall conclusions are
not changed after performing these tests.

9.3 Multicollinearity

Given the p-values, there is an indication of problems with multicollinearity. One
reason could be that several of the independent variables are closely related.
Another reason is the possibility that the sub variables, which are applied when
discussing firm complexity and board diversity, are likely to measure the same
effects. To check for this, a collinearity matrix in EViews was used (Appendix 6).
The largest observed correlation in the collinearity matrix is 0.3116, between the
long-term debt and the return on assets. This collinearity is expected since the
variables both contain total assets. However, it is small enough not to present a
problem of multicollinearity in Equation 1.

Especially when the sample is divided into quintiles the problem of collinearity
occurs. One way to resolve this problem is to reduce the number of independent
variables that are collinear, until there is only one left (investopedia.com). By
removing the variable employee-elected the problem we experienced was solved.
10. Conclusion

This paper examines the determinants of board size using a sample of approximately 250 000 unique firms, and the development from 2000-2011. The sample strictly includes Norwegian private firms of all ages, sizes and industries. The large sample combined with the heterogenic selection makes it possible to generalize from the results. By separating the data into the groups; small, medium and large, we found large differences between the groups. As expected the large group reacted quite different to the determinants than the two others.

Our findings tell us that the board size is affected by the size of the firm. The larger the firm the larger the board is. This can be seen from the positive statistically significant Sales in table 5, as well as the mean for the large group (46 million) is much higher than for small (4.4 million) and medium (7.3 million). These findings confirm hypothesis 1.

Firm complexity is believed to increase the board size. The results that we found are inconsistent with our expectations and not statistically significant for R&D/TA and LTD/TA. Firm Age ln is statistically significant with a positive sign, so it partially confirms hypothesis 2. However, Firm Age^2 does not have the expected negative sign, not confirming the hypothesis about a non-linear relationship. Overall, hypothesis 2 are partially confirmed, but should be further investigated.

One important finding in this paper is that employee-elected, family and female representatives are important factors influencing the size of the board. They are all positive, statistically significant at the 1% level, and their presence increase the board size. These findings lead to a higher firm complexity, which again leads to larger boards. Looking at these results hypothesis 3 is confirmed. In addition to this, the rub off effect of the gender law quota was addressed, and the increase of female board members indicates that there is a rub-off effect in the private market.

ROA has a positive sign, however it is not statistically significant. When the regression is grouped, small and medium are statistically significant, but with a negative sign. The large group has a positive sign, but is not statistically
significant. These results make it difficult to draw any conclusions, and it is not possible to confirm hypothesis 4 based on these numbers.

The results are in general consistent with efficiency explanations of the determinants of board structure. Our model explains as much as 24% of the observed total variance in the model.

Overall, the results we have found suggests a strong relationship between firm size, firm diversity and board size. This indicates that an increase in the former two will lead to an increase in the latter. Additionally, there seems to be a rub-off effect of the gender quota law in the private market. This means that the private market should pay attention to reforms that are implemented in the public market as well.
Bibliography


Berzins, Janis and Øyvind Bøhren. 2009. “Unoterte aksjeselskaper er viktige, uutforskede og spesielle.” Senter for eierforskning, Handelshøyskolen BI.


Zainal, Dalilawati, Norhayah Zulkifli and Zakiah Saleh. 2013. “Corporate Board
## Appendix

### Appendix 1: Base case regression output

![EViews Output]

**Dependent Variable:** BOARDSIZ  
**Method:** Panel Least Squares  
**Date:** 08/26/13  **Time:** 18:36  
**Sample:** 2000-2011  
**Periods included:** 12  
**Cross-sections included:** 244543  
**Total panel (unbalanced) observations:** 1351920

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<th>t-Statistic</th>
<th>Prob.</th>
</tr>
</thead>
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**Effects Specification**

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Side 35
### Appendix 2: Mean and median for Firm Age

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Appendix 4: Hausman Test

[Table showing Correlated Random Effects - Hausman Test with test period random effects]

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[Table showing Period random effects test comparisons]

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Period random effects test equation:
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- Time: 18:40
- Sample: 2000 2011
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- Total panel (unbalanced) observations: 1351920

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Effects Specification

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Appendix 5: Robustness test

Robustness test output

![Lagged regression output](image)

Lagged regression output
### Appendix 6: Collinearity matrix

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Appendix 7: Preliminary

Board composition in private firms

1 Introduction

Hermalin and Weisbach (2003) emphasize that board composition is endogenous and bound to develop with firm characteristics over time. Thus, the important question arises: What are the determinants of board composition? We will look into the determinants of board size for Norwegian non-listed (private) firms.

According to Goergen-Renneboog (2006), a Corporate Governance system can be defined as the combination of mechanisms, which ensure that the management (the agent) runs the firm for the benefit of one or several stakeholders (principals). Boards are considered to be one of the most important issues within the corporate governance field (Huse and Søland 2009). Furthermore, corporate board structure and its impact on firm behavior is one of the most debated issues in corporate finance today. This might be a consequence of the Enron and Worldcom scandals, as well as an increasing trend of researching determinants of board structure (Linck et al. 2008). Hence, the literature is constantly expanding providing new findings within the field.

In Norway, private firms constitute the vast majority of both total number of companies and value creation. In fact, over a period from 1994-2008, Norwegian non-listed companies accounted for 99.9% of the total number of companies. Additionally, the non-listed firms represented 79% of the total turnover (Bøhren 2011, 35). However, most of the existing literature is based on information from American public firms, much because the information availability is higher for the listed firms than the non-listed. Additionally, previous research has been dominated by board independence, whilst board size has not been researched to the same extent. This thesis will therefore focus on Norwegian private firms, where we will investigate whether the board size affects the performance, and some characteristics that may affect the board size.

---

2 Stakeholder: anyone with an interest in the firm, such as lenders, government, environmental organizations and workforce (Brealey, Myers and Marcus 2012).
Moreover, there are several reasons for why we believe that this paper’s result may differ from other studies focusing on listed firms. The main reason is the difference in data being used. It is reason to believe that the non-listed Norwegian firms will provide different results than the large public firms in the US did. One example being the difference in firm size; the private Norwegian firms are much smaller on average than the public U.S firms used in previous research, and this might affect the determinants of board size. Another reason might be that small non-listed firms, like those in our sample, experience pressure to include family members or other acquaintances to the board even though it is not contributing to optimize value (Eisenberg et al. 1998). A third reason for why this paper might contribute to the existing research is that the data is based on private companies that are not under the same regulation as the public companies. If this research were done on public firms in Norway, the companies would be obliged to follow restrictions with regards to for example the female quota and employee directors. This is not the case for the private firms, except the few ASA firms, and might provide different results than the existing empirical studies.

Public firms have rules and recommendations they are obliged to follow, and these are likely to affect the determinants of the board structure. One example of this is that independence increases due to the female quota (Bøhren and Staubo 2012). As seen in Figure 1 the law of female quota has not influenced the number of women significantly in AS boards, indicating that these companies has not been affected in the same way as the ASA firms. So the private firms are not as influenced by the regulations as the listed ones. Another reason is that, compared to the public firms, private firms may differ a lot with regard to size and composition amongst each other. The public firms are ASA firms, while the private firms differ from large ASA firms down to firms with only one employee. The difference in the structure within the group can have a strong impact on the board structure, and the board size in particular.

![Figure 1 Source: SSB](image-url)
Below, we will present the characteristics that may affect the board size in a Norwegian non-listed firm. First, we will highlight some of the existing theory. Then we will present our hypotheses, and we will list the independent variables that we consider relevant, including the relevant proxies. In the end, our regression line will be presented to provide a general overview.

2 Theory

The theory we present is used to find appropriate variables explaining board size, as well as the relationship between board size and performance. This will be the foundation of the empirical work that we will perform later in this thesis, and the study is based on whether board size has an effect on the performance of the firm. To investigate this we will use different characteristics to see whether larger/smaller boards affect the performance of the firms. This will be further discussed later in the text.

According to Adams and Ferreira (2007) and Raheja (2005), the board of director’s responsibilities can be divided into two different functions: monitoring and advising. Very generally, the monitoring function consists of overlooking the management, making sure unwanted and harmful behavior does not occur, in example fraud. The outsiders are believed to perform this task with the most satisfactory outcome, because they are more perceived as more independent than the insiders. However, this function is not contributing to maximizing stockholder wealth, and the outsiders do not have the same knowledge about the firm specific constraints and opportunities as the insiders. The advisory function helps the management making good decisions with regards to the company’s strategy and actions, increasing the stockholder wealth. Raheja (2005) argues that the insiders have knowledge about important firm-specific information, but their objectives are distorted because of private benefits and lack of independence from the CEO. The optimal structure is a function of monitoring and advising with regards to costs and benefits given the characteristics of the firms, including other governance mechanisms. Since there are advantages and disadvantages with both the functions, it is important for the firms to find their optimal amount of monitoring and advising. When monitoring is high, there tend to be more
outsiders. These outsiders have less insight in the firms operations, making the information flow less efficient.

2.1 Firm size

Both Booth and Deli (1996) and Pfeffer (1972) argue that larger firms most likely are dependent on more external relationships, which would require a larger board. This is in accordance with Lehn et al. (2004) that documented a positive, significant relationship between firm size and board size. This relationship was also tested and confirmed by Boone et al. (2007). Log Sales give us an indication about the size of the firm. Another good indicator of the size is the log of book value of assets. We choose to use the latter in our base case regression to proxy for firm size, and log sales when performing the robustness test. We define board size as the number of directors on the board including both insiders and outsiders. An insider is defined as a board member with a connection to the company, such as an employee (including former employees and family related) or a stakeholder.

2.2 Firm complexity

Linck et al. (2007) argues that the monitoring and advisory function is related to the firm complexity, and that firm complexity influences the board size. One reason being that complex firms need more expertise in the board, as well as more advising, which in turn would require a larger board of directors. According to Fama and Jensen (1983), the cost of monitoring is increasing, as the company become more complex, but the benefits from effective monitoring is believed to outweigh the increasing cost.

On the other hand, adding directors contributes with important information and advising, but it also increases the free-rider problem and coordination costs, as well as the direct costs (Linck et al. 2007). Maug (1997) states; “for a firm with high information asymmetry it is not optimal to invite monitoring from independent directors, because it is costly to transfer the firm specific information to the outsider”. This suggests that the cost of monitoring and advising should lead to a decrease in board size. A measure commonly used to proxy for monitoring and advising costs is the standard deviation of stock returns (Linck et al. 2007). However, this is just available for the listed firm so we will use the
standard deviation of book return on assets. The board size is expected to decrease when there is high volatility (Bøhren and Staubo 2012). According to Coles et al. (2008), capital structure affects the board size as well. Furthermore they believe that high leverage leads to larger board of directors. This is due to the fact that they are more dependent on external resources, increasing the need for advice. Hence, a larger board is required. Based on this theory and empirical research, Debt/total assets are considered to be a good proxy for firm complexity. This ratio presents an overview of the financial position in the firm. Additionally, it gives us an idea of how the company is able to meet their financial obligations. Another proxy one may use regarding firm complexity is Firm Age. According to Boone et al. (2007) firm complexity namely increases with the age of the firm. They argue that firm complexity will increase until the company reaches the mature phase in the product life cycle. However, it is not clear that this linear trend will continue when the firm enters this phase. To test for this we include both Firm Age and Firm Age\(^2\) as proxies. The Firm Age\(^2\) is included to make sure that the relationship between influence of age and firm complexity is non-linear.

### 2.3 Board diversity

Another factor that might influence the board size is the degree of board diversity. Board diversity is defined as board members with a varied combination of attributes, such as nationality and gender, in addition to number of employee-elected representatives. Fauver and Fuerst (2006) state that the employee directors take on the advisory role when becoming a member of the board. One may argue that they possess information that is useful with regards to the employees. However, they might not have the knowledge that is required to discuss other issues. Thus, one may expect that these employee directors are not replacing existing members, but are simply added to the board. In other words, this would suggest a positive relation between share of employee-elected representatives and board size. To measure the number of employee-elected representatives on the board, we will use the number of employee elected to total number of board members.
The share of female directors on the board is considered to be an important issue with regards to board diversity. Even though the majority of the firms in our sample do not need to follow the gender quota law, there might be a side effect of the law, rubbing off from the listed firms. They might influence the non-listed firm’s values, and encourage them to increase their share of female board members. There are two ways to increase the female share; either replacing the existing board members or adding new female members to the board. Increasing the board size to include female directors can be associated with a firm’s need to increase board diversity (Farrel and Hersch 2005). To measure the share of women in the board, we simply use the number of women to total number of board members.

The share of family members is also considered to influence the board diversity. As mentioned previously, smaller firms might be forced to include family members in the board, even though it is not contributing to optimizing value. This might lead to a larger board, because the family member is just added to the board, instead of replacing existing members (Eisenberg et al. 1998). One potential explanation for this is that the board cannot afford to lose the existing competency in the board. Additionally, family firms are believed to have a lower impact on performance than the non-family companies. For family firms this may imply that a smaller board size is a better way of governing than for the non-family firms (Ibrahim et al. 2011). The share of family members is measured as the number of family seats for the largest family relative to the total number of seats at the board.

Jensen (1993) argues that large boards have higher costs monitoring firms in growth. This also applies to the cost of advising by outsiders. A way to reduce the monitoring costs is according to Raheja (2005), to have boards that are aligned with the shareholders interests. The board will then act in accordance with the shareholders best interest, and not take on inferior projects, which again will result in smaller boards. This is very hard to test for in the non-listed market, because the information needed is not available for all the firms. Not testing for this feature, which has the opposite effect of the ones mentioned above, can be a
weakness in our model. However, we believe that the effect from such a measure is minimal, so it won’t affect our results significantly.

2.4 Performance

The association between board characteristics, i.e. board size, and firm performance is a fundamental issue in the corporate governance literature. A number of studies have documented a negative relationship between board size and the level of corporate performance (Yermack 1996, Eisenberg, Sundgren and Wells 1998 and Cheng 2008). This result is also in accordance to the perception that coordination and communication problems, as well as agency problems, become larger as the board grows. Furthermore, larger board of directors are likely to be associated with less variable corporate performance. This is due to the coordination and communication problems of a large board slowing down the decision process, as well as moderating the extremity of the decisions made by the board. Less extreme decisions are likely to imply neither very good nor very bad decisions and hence, less variable corporate performance (Cheng 2008).

3. Hypothesis

3.1 Firm size

From the theory section above we see that several factors are believed to influence the size of board of directors. The relationship between firm size and board size has been tested a number of times (Lehn et al. (2004) and Boone et al. (2007)), and based on these studies we presume a positive correlation between the two. To proxy for firm size we use log of book value of assets.

Hypothesis 1: firm size will increase the size of the board of directors.

3.2 Firm complexity

Another factor assumed to have a positive relationship with board size is firm complexity. This is due to the increased need for advice and expertise. Capital structure is believed to explain board complexity and to proxy for this we use debt to total assets. As mentioned in the theory, also the company’s position in the product life cycle is assumed to affect the board complexity. Thus, we include the proxy’s firm age and firm age$^2$. Firm complexity can also be explained by a
company’s growth opportunities, and to proxy for this we use the standard proxy R&D.

**Hypothesis 2: firm complexity will increase the size of the board of directors**

### 3.3 Board diversity

Furthermore, the degree of board diversity might also influence the board size. As mentioned in section 2.3 Board Diversity, we choose to include the number of employee-elected representatives, women and share of family representatives in the board. Regarding the share of employee elected directors we presume a positive correlation with board size. Based on the theory section we also presume a positive relation between both share of women and share of family representatives in the board and the size of board of directors. To proxy for firm complexity we have already included R&D, which is a standard proxy for growth opportunities and hence, complexity.

**Hypothesis 3: board diversity will increase the size of the board of directors.**

### 3.4 Firm performance

Moreover it is expected that there is a relationship between board size and firm performance. Among the existing literature on this topic we find that the possible difficulties regarding coordination and communication problems, as well as agency problems, are believed to increase when the board size become larger. Based on this we expect a negative correlation between board size and firm performance. To test for this we include a variable called AN_ROA in our regression line.

### 3.5 Dependent and independent variables

To summarize the theory above we have the following dependent and independent variables:

**Dependent variable:**

- Board size

**Independent variables:**
• Firm size (hypothesis 1)
• Firm complexity (hypothesis 2)
  o Capital structure
  o Place in product life cycle
  o Growth opportunities
• Board diversity (hypothesis 3)
  o Employee-elected representatives
  o Share of female directors
  o Share of family representatives
• Firm performance

In other words, we assume that firm size, firm complexity and board diversity are important when determining board size. Additionally, in order to capture the relationship between board size and firm performance, we have included firm performance as an independent variable.

3.6 Proxies
In this chapter we will summarize and describe the proxies we find necessary to characterize the three attributes above. Doing this, we mainly use theory and some previous empirical research. In the end of this section we will also present them in a regression line.

• **BV Assets**: Log of book value of assets last fiscal year. This proxy measures the firm size.
• **Sales**: Log Sales in NOK million in real terms. This proxy measures the firm size. However, it will be included in the robustness test and not in the base case regression.
• **Debt to total assets**: Long term-debt divided by total assets. We use debt ratio to specify the capital structure, which again indicates firm complexity.
• **STD**: standard deviation of book value of assets. Measures the monitoring and advising costs the last 10 years, which is an indicator for firm complexity as well as firm size, due to standard deviation not being independent of scale.
• **Firm Age**: we use this to find out whether a firm is “mature” measuring the firm complexity. We also include $Firm \text{ Age}^2$ to make sure that the relationship between influence of age and firm complexity is non-linear.

• **R&D**: this is R&D expenditure divided by total assets. This is a standard proxy for growth opportunities explaining firm complexity and board diversity (Linck et al. 2007).

• **FAM_OWN**: largest family’s number of board seats relative to the total number of board seats. This will measure board diversity.

• **FEM_SHA**: female board members divided by total number of board members. This will determine the share of women in the board.

• **EMP_SHA**: employee elected board members divided by total numbers of board members. This will measure the share of employee elected in the board.

• **IND_DIR**: number of independent board members divided by total board size.

• **AN_ROA**: This is net income divided by total assets. Annual return on assets measures firm performance.

In our base case we choose to only use one proxy per board characteristic. The remaining proxies will be applied when performing a robustness test later in the thesis.

The following proxies will be used in our regression line:

\[
Board\ size = \alpha + \beta_1 BV\_Assets + \beta_2 Debt + \beta_3 STD + \beta_4 Firm\text{ Age} + \beta_5 Firm\text{ Age}^2 + \beta_6 R\&D + \beta_7 FOR\_REV + \beta_8 FEM\_SHA + \beta_9 EMP\_SHA + \beta_{10} IND\_DIR + \beta_{11} AN\_ROA + \varepsilon
\]

### 4 Data

We will use the CCGR database to find different data to perform our regressions. This database contains, among others, firm-specific financial statements data and detailed information about the identity of board members and top executives (Abdolmohammadi et al. 2010). From this database we will extract a number of
non-listed firms. However, we will filter them to avoid data entry errors. Such filtration could be revenue, activity, size (assets or employment) and venture. Additionally, we will not include financial companies. This is due to the 10 percent restriction on the owner concentration, and their atypical accounting numbers, such as high debt and few assets (Bøhren 2011, 112). This may influence our proxies, such as BV_ASSETS and DEBT, in a way that makes them less representative for the rest of the data. The CCGR database is a very accurate database with cleaner numbers, compared to other countries. This is due to Norwegian law, which impose all AS and ASA to report their annual accounts by the same template (Bøhren 2011, 34). Most of the data in the CCGR database goes back to 1994. However, some of the data are from 2000. Thus, we choose to set the time horizon to be from 2000-2010. We consider using Account data, Ownership control, Family and Consolidated account data.

To run our regressions, we will use the statistical software EViews. This will also help us making descriptive statistics. Regarding the regressions, we will use the Ordinary Least Squares (OLS). One of the assumptions of the OLS is that there is zero covariance between the disturbance term and the variables. If this assumption is violated, we may have a problem of endogeneity. According to Hermalin and Weisback (2003), it is difficult to perform empirical studies on boards. One of the main reasons is that there is a problem of joint endogeneity, and this should be carefully addressed because the results are difficult to interpret. This is due to the fact that the board composition may be affecting the determinant we are testing for. To reduce endogeneity problems, we include both industry and year fixed effects in our models, examine the robustness of our results after including lagged values of our dependent variables and estimate our models in a simultaneous equations framework.

5 Time Schedule

- Data collection: February 1st 2013
  - CCGR:
    - Account_data
    - Ownership_control
• Family
• Consolidated account data

• Run regressions and begin analysis: March 11th 2013
• Read through of complete thesis: June 1st 2013
• Final delivery date: September 1st 2013

Bibliography

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