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Female CEOs: Why so Few?

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Abstract

There has been much debate on CEO gender and its effects on firm performance and characteristics. In this paper, we tried to explain the reasons for female chief executive officers (CEOs) fewness, while examining the attributes that might influence the appointment of female CEOs in a sample of Norwegian companies. We extended the literature since the previous research was focused mostly on the factors that influence boardroom diversity and not the CEO gender. Our analysis was based on 40,880 unique Norwegian firms over the period 2000-2014. The results of logistic regressions showed that the profitability of the company and the number of female directors on board increase the probability of CEO being a female. It is more likely that the CEO be a female in family firms and firms owned by institutional owners. The leverage ratio as debt-to-equity ratio, state ownership, and CEO being a family member variables had negative effect on the odds of the CEO being a female. The firm size in terms of number of employees and international ownership did not affect the CEO gender. The quota policy influenced successfully the CEO gender change from male to female.

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Introduction

Several studies have been conducted on gender diversity in firms. They have focused on different positions in organization including board of directors, labour force, and in a few cases executive managers, chief executives and financial officers (CEOs and CFOs) (Peni & Vahamaa, 2010). These studies examined the association between gender and a variety of firm characteristics.

More specifically, research in finance and corporate governance has been mostly focused on the effect of female directors on company performance (Carter et al., 2003; Adams & Ferreira, 2009; Gul et al., 2011; Matsa & Miller, 2013; Gregory-Smith et al., 2014), the different management styles of female leaders (Gul et al., 2011; Huang & Kisgen, 2013; Matsa & Miller, 2014), and gender diversity in boardroom (Adams & Ferreira, 2009; Ahern & Dittmar, 2012; Matsa & Miller, 2013).

In these studies, the company characteristics appointing a female CEO are not necessarily the main focus of the analysis. However, few of them present descriptive statistics on the relationship between the company characteristics (industry, size, age, etc.) and the appointment of a female CEO. Therefore, to individualize our study, we conduct a thorough research on the firm attributes that lead to a female CEO appointment.

We examine how firm performance, capital structure, ownership structure, board of directors gender diversity, and firm size, in terms of number of employees and revenue, affect CEO gender. Previously, the researchers mostly focused on the reverse relationship or the influence of these factors on board of directors structure. Hence, it is interesting to discuss the question the way we propose. Furthermore, we expand the research by examining effects of several ownership types on the CEO gender comparing to the previous works where only family and state owned firms were discussed. In the last part of our analysis, we study the effect of Gender Quota Law on CEO gender change for the years after law execution.

Our results showed that the fraction of female directors and firm`s size in terms of revenue positively influence the probability of the CEO being a female. Furthermore, it is more likely that the CEO to be a female in family firms and firms owned by institutional investors. On the other hand, the higher the leverage ratio is, the less probable is a female CEO. State ownership has also a negative effect on the

odds of the CEO being a female. Moreover, we found that a CEO who is a family member is less likely to be a female.

Finally, return on assets as company performance, international ownership, and employees number have no influence on the CEO gender. We also found out that the Gender Quota policy was quite successful.

We organized this paper as follows: first, we study the existing literature on the factors relationship with the CEO gender. Then, according to the theories presented in the most influential papers we state the research hypotheses. Next, we discuss the analysis methodology for the cross-section data analysis and define our regressions. Lastly, we describe the data set we use, which is a sample of Norwegian companies in different industries provided by CCGR database at BI Norwegian Business School. Finally, we present our results and provide conclusion on our study.

Literature Review

Psychology and management literature have long acknowledged that significant gender-based differences exist, for instance, in leadership styles, communicative skills, conservatism, risk averseness, and decision-making (Vahamaa, 2010). These differences and their implications have received growing attention during recent years and several studies have surveyed women's role and performance in firms.

Since the ultimate purpose of this paper is to answer the question why there are so few female CEOs, we first study the factors influencing the CEO being female in companies. We review related literature in five parts to address the effect of firm performance, capital structure and risk taking, ownership structure, board of directors gender diversity, and firm size on CEO gender.

Some of the works discussed these factors impact on the board gender diversity, the reverse effect, or the comparison between firms with CEOs of either gender in these variables. These results are also valuable for us in terms of the used methodology and research expansion.

2.1. Firm Performance and CEO Gender

Very few studies have been done on the effect of firm performance on CEO gender to be a female. However, there are numerous ones about the reverse relation, which we review in this part.

The majority of the existing literature supports the positive relation between female contribution in executive positions, including CEO, and firm performance in terms of different measures including profitability, earnings, and shareholders' wealth. Krishnan & Parsons (2008) found earnings quality is positively associated with gender diversity in senior management. They realized that companies with more women in senior management tend to be more profitable and have higher stock returns after initial public offerings than those with fewer women in the management ranks. Another research on CEO gender and firm performance was conducted by Khan & Vieito (2011). They concluded that firms with female CEOs are associated with an increase in performance compared to those with male CEOs.

Welbourne (1999) also examined the effect of having women on the top management teams of IPO firms on the short and long-term financial performance of companies. She showed women have a positive effect on firms' short-term performance (Tobin's Q), three-year stock price growth, and growth in earnings per

share. In another study, Francoeur et al. (2008) found that firms with a high proportion of women in both their management and governance systems generate enough value to keep up with normal stock-market returns.

Despite the studies that found positive association between female CEOs and firm performance, some studies did not find a strong relation or proved opposite association. For instance, Peni & Vahamaa (2011) surveyed potential effects of female executives on earnings management. They found no relationship between earnings management and CEO gender. Before Peni & Vahamaa (2011), Woflers (2006) examined the association between stock return and CEO gender using S&P 500 firms over the period of 1992-2004, and found no systematic differences in returns to holding stock in female-headed firms.

In addition to the above-mentioned studies, there are several surveys that investigated the effect of board of directors gender diversity on firm performance. Carter et al. (2003) presented the first empirical evidence examining whether gender diversity in boardroom is associated with improved financial value using data from Fortune 1000 firms. They concluded that there is a significant positive relationship between the fraction of women or minorities on the board and firm value. In another investigation, Erhardt et al. (2003) showed positive relation between board of directors gender diversity and firm performance in terms of profitability using data from 127 US companies. Campbell & Minguez-Vera (2008) also studied Spanish firms and found gender composition of the board can affect the quality of monitoring role and thus the financial performance of the firm; they documented that gender diversity has a positive effect on firm value.

2.2. Capital Structure and CEO Gender

Numerous studies have been done in psychology and management about the gender-oriented behavioural differences including risk aversion and overconfidence. Besides, finance literature includes several researches about the implications of these differences on female corporate decision-making and capital structure in firms.

The majority of these studies found that females are more risk averse and have a lower tendency to make risky decisions. Powell & Ansic (1997) surveyed gender risk averseness. They concluded that females are less risk seeking than males and adopt different strategies in financial decision environment, so that these strategic

differences may reinforce stereotypical beliefs that females are less able financial managers. In another research, Dwyer et al. (2001) found the same relation. They provided evidence that women exhibit less risk taking than men in their most recent, largest, and riskiest mutual fund investment decisions, using data of nearly 2000 mutual funds.

Huang & Kisgen (2011) surveyed male and female executives' overconfidence. They showed that female executives place wider bounds on earnings estimates and are more likely to exercise stock options early. They concluded that men exhibit relative overconfidence in significant corporate decision making as compared to women.

Barber & Odean (2001) analysed common stock investments of men and women using account data for over 35000 households from February 1991 through January 1997. They documented that men trade 45 percent more than women do, and based on theory that overconfident investors trade excessively, they concluded that men are overconfident comparing women.

Following the above-mentioned studies on gender difference in risk averseness and overconfidence, there are few studies on the effect of CEO's personal characteristics on their corporate decision-making. Cronqvist et al. (2010) empirically showed that firms behave consistently with how their CEOs behave personally in the context of leverage choices. They found a positive economically significant relation between personal and corporate leverage. In another survey, Cain & McKeon (2012) studied CEO personal risk taking, corporate policies, and overall firm risk. They documented that risk seeking CEOs have higher leverage and greater stock return volatility; besides, sensation seeking CEOs increase overall firm risk through more frequent acquisition activity.

Furthermore, in our specific topic of interest, Faccio et al. (2016) documented that female CEOs tend to avoid riskier investment and financing opportunities. They also showed firms run by female CEOs have lower leverage, less volatile earnings, and a higher chance of survival than firms run by male CEOs.

2.3. Board of Directors Gender Diversity and CEO Gender

The issue of women’s participation in board of directors and executive management positions is a frequently discussed topic, both in the popular press and in scientific research. The gender diversity of the board has an important role in the recent

governance reform efforts worldwide. Nonetheless, the consequences of changing the gender diversity of the board still have to be researched.

There is not so much discussed about the board of directors gender diversity impact on the CEO gender. Mostly the scientific papers focus on other issues including the impact of female CEO on gender diversity in the boardroom and the percentage of existing female directors impact on further board gender diversification.

Farrell & Hersch (2005) analysed the determinants and effects of the appointment of females as new board members in the U.S. They indicated that the percentage of females already on a board has a negative relationship with the likelihood of a female being added to the corporate board. Adams & Ferreira (2009) suggested that in general even if the female directors have been selected due to tokenism, they have a substantial impact on the board structure.

In another research, Parrotta & Smith (2013b) studied the determinants of female presence on board of directors in Danish companies and concluded that the companies with a female director on board have a significantly lower probability of having another female on the board of directors. Furthermore, Smith et al. (2013) indicated that a female chairman on the board of directors affects negatively the chances of a female promotion to the CEO. Finally, Adams & Kirchmeier (2013) came to the conclusion that it is unclear that boardroom diversity leads to more women in executive positions.

All these results can be interpreted as evidence of tokenism hypothesis, which implies that individuals whose social category is underrepresented in particular contexts will face negative experiences such as increased visibility and social isolation (Kanter, 1977).

On the other hand, Billimoria (2006) reported a positive relationship between the presence of female corporate directors and the representation of female executives in Fortune 500 top management teams. The findings of this study empirically support the notion that female corporate board directors and top management gender diversity are positively related. It is stressed that corporations that want to improve the gender diversity of their senior management team would do well by enhancing the gender diversity on their boards.

Furthermore, several reports of Catalyst (1993, 1995, 2004, 2005, 2007, 2007) and Joy (2008) showed a clear and positive correlation between the percentage of

female directors in the past and the percentage of female corporate officers in the future. In addition, Matsa & Miller (2011) and Elkinawy & Stater (2011), who performed analysis among the listed U.S. companies, found a positive spill over effect of the presence of female board members on the probability of having female top executives.

Soares et al. (2012), who studied the relationship between the percentage of company`s female directors in 2001 and the percentage of women corporate officers of the same company in 2006 among the Fortune 500 companies, confirmed their results. Amore et al. (2014) found consistent results that female CEOs' boardrooms have fewer directors, are more gender diversified and more independent, have better director attendance, and have higher overall board monitoring index. They also showed for family-controlled firms in Italy that companies led by female CEOs perform significantly better with increasing numbers of women on board of directors.

Furthermore, Charles et al. (2015) showed that firms with at least three women on board are more likely to be run by a female CEO. This result is significant because it demonstrates the presence of women in positions of visible authority may encourage and support effective representation of women on boards. Finally, Frye & Pham (2015) found that female directors have a substantial and value-relevant impact on board structure. However, they highlighted that this evidence did not provide support for quota-based policy initiatives. No evidence suggested that such policies would improve firm performance on average.

2.4 Ownership Structure and CEO Gender

Much of the debate and analysis is focused on the effect of gender diversity on firm performance in larger, often listed companies (Carter et al., 2003). The quota laws in Norway and in other countries have also been enacted to include only listed firms. Consequently, the largest share of companies within the economy has been excluded both in the public debate and in the academic research.

Bohdanowicz (2015) performed an analysis on Polish companies and got several results regarding ownership concentration impact on board diversity. First, there is a positive relationship between managerial ownership and supervisory board diversity since owner-managers appoint to the supervisory board member of their families, including women. Thus, they increase gender diversity in the boardroom,

but without the utilization of the advantages of gender diversity. Second, there are positive relationships between state ownership and board diversity since companies with state ownership could take advantage of gender diversity in the boardroom. Third, there is a negative relationship between financial investors' ownership and supervisory board diversity.

According to Morikawa (2014), listed and long-established companies, subsidiaries, and unionized companies tend not to have female directors. On the other hand, owner-managed companies are likely to have female directors and CEOs. However, in the owner-managed companies, those from the founder's family including spouse and daughter have a greater chance to become director, and in some cases, they are promoted to CEO through the succession among family members.

Sekkat et al. (2015) wondered whether factors linked to ownership and corporate governance could explain why some firms in the developing world are more reluctant to hire female CEOs. They discovered that ceteris paribus, when the dominant shareholder is a woman, the CEO is also much more likely to be a woman. Bjuggren et al. (2015) showed that female leadership is more common in family than in non-family corporations. In contrast, Eklund et al. (2009) empirical analysis showed that ownership concentration does not affect board size or board composition.

2.5 Company Size and CEO Gender

Du Rietz & Henrekson (2000) analysed the influence on firm performance from women on boards for Swedish firms. They stress the importance of controlling for firm size and sectors. In addition, Smith et al. (2005) highlighted that the size of the firm is frequently used as a control variable in financial performance analysis since it may correlate with the percentage of females on boards. In terms of company size, studies in the U.S. generally found that the company size is positively associated with the number of female directors (Carter et al. 2003; Farrell & Hersch, 2005; Adams & Ferreira, 2009; Gul et al., 2011).

Charles et al. (2015) results show that the likelihood of the development of a critical mass of women on a specific board increases with firm size. This is consistent with Agrawal & Knoeber (2001), Hyland & Marcellino (2002), Carter et al. (2003), and

Wang & Clift (2009) who also showed a positive relation between firm size and the percentage of women directors.

An exception is the paper by Bertrand & Hallock (2001), which indicated that the size of companies with female directors is relatively small. Moreover, Morikawa (2014) concluded that the company size and foreign shareholdings do not have significant relationships with the presence of female directors. Regarding female CEOs, Wolfers (2006) suggested that the size of the companies with female CEOs is slightly smaller than with the male counterparts.

However, there is a difference with respect to size of the company (number of employees) between companies led by a female CEO and companies led by a female chairperson on the board of directors. The latter companies tend to be smaller, while companies with a female CEO tend to be larger than the full sample (Parotta & Smith, 2013a).

2.6. The Gender Quota Policy

The issue of female executives was not on the political agenda for many years even after the 1970s when women`s movements started. Among the Nordic countries, Norway has done quite a lot for the gender equality of employment, especially in the public sector. Nevertheless, the situation was very different in the private corporate sector. In 1990s, the general opinion in the corporate world was that eventually a gender balance would evolve and there is no need for drastic actions. Still the idea of a quota law was circulating within the social democratic party, amongst feminist politicians, and feminists in the civil service. Finally, the Gender Equality Act was under review in 1999. One of its proposals was the introduction of gender quotas to corporate boards as well as in the public sector. The argument for a quota law was based on the fact that women should have equal representation in all positions of power and influence, including corporate boards. Unfortunately, the initiative was not taken seriously. However, the corporate sector started paying more attention to the role that boards of directors could play in corporate governance and value creation.

Later, in 2002, the Minister for Trade and Industry Ansgar Gabrielsen was continuously raising the attention to “the boys club” problem since women were not taken on boards. Moreover, he emphasized that he was ready to act and that he would not rule out the idea of a quota law (Bolsø & Øyslebø Sørensen, 2013). This

caused a big discussion. The CEOs and investors were not opposed to taking women on boards but they did not like the idea of the quota law as they considered it a deprivation of the right to choose men. Therefore, the new argument that the politicians used was that increasing the number of women on boards will increase profitability due to using the talents to the full potential. The tactics appeared to be quite successful.

However, the rhetoric was changed later since equality is an important issue in Norway. Therefore, gender quota became a combination of equality and business profitability issues. The politicians started talking about diversity in the boardroom. This raised several questions for feminist scholars. First, whether the male dominance is acceptable if it could be proved that female presence on boards does not increase profitability. Second, whether women would be seen as second-rate board members since they are very different from men. Third, whether quota regulation for female attendance on boards would cause them to be regarded as having inferior positions. The public debate answered «no» to all of them (Bolsø & Øyslebø Sørensen, 2013).

In 2003, the Norwegian government passed a law that requires companies to have at least 40% of company board members to be women. In place since 2006, it stipulated dramatic regulatory measures for non-compliance. The Quota Law was implemented in 2008. It strengthened general gender awareness and made clear to the public that the directors` competence is not related to their gender. There is research showing that women seem to change the character of the boardroom for the better.

The effectiveness of quotas has been debated in some countries. Although the targets for female representation on boards in Norway have been met, unfortunately, the appointed female board members were often inexperienced and did not create additional value (The Economist, 2011). Currently, Norway has approximately 40% female representation in boards of directors. However, there are still quite few women in top executive positions. Therefore, it should be admitted that board gender quotas are not in themselves sufficient to get more women in executive positions, but the law has most likely contributed to helping Norwegian women start the changes (Fosen, 2013).

Seierstad et al. (2010) showed that a substantial increase in the proportion of women on boards in Norway occurred only during the implementation period of the gender

representation law, and especially towards the end of that period. This suggested that the law had successfully challenged the under-representation of women on boards of public limited companies and made the boards more balanced in terms of gender. In addition, women's access to the most senior positions within boards remained restricted as the share of companies with a woman chair has remained low and stable after the implementation period. However, the research has indicated while women participation has increased, senior positions remain restricted to men.

Outline

From the literature review, it is clear that there are different groups of factors that influence the CEOs` gender and board diversity. We will estimate their effects on the Norwegian companies separately and all combined. We are also highly motivated to investigate how the Gender Quota law has affected the CEO gender in Norwegian companies.

Theory

The research question “Female CEOs: why so few?” which is the title of our study suggests a main question regarding the female CEOs scarcity in Norwegian companies. Therefore, we test if there are significant effects of firms profitability, leverage usage, board of directors gender diversity, ownership type, firm size, and quota policy treatment on the probability of the CEO being a female. The aim of our research is to study all these factors separately and combined to see how firm characteristics affect CEO gender. To perform the analysis and regarding the previous studies related to our topic, we construct six hypotheses.

3.1. Firm Performance and Female CEOs

According to previous studies, there is a positive relationship between females contribution in executive positions, including top management, CEO, board of directors, and firm performance (Krishnan & Parsons, 2008; Khan & Vieito, 2011; Welbourne, 1999; Francoeur et al., 2008, Khan & Vieito, 2011). We base our theory on these results but for reverse effects, the effect of firm performance on the probability of CEO gender to be female. Accordingly, we expect to find a positive relation between firm performance and the likelihood of having a female CEO.

Hypothesis 1:

"Better financial performance increases the probability of appointing a female CEO in a firm."

3.2. Female CEOs and Capital Structure

Previous literature has found that females are more risk averse (Powell & Ansic, 1997; Dwyer et al., 2001) and CEO’s personal behaviour affects her corporate decision making and firm leverage (Cronqvist et al., 2010; Cain & McKeon, 2012). According to these findings, it is expected that female CEOs, as risk averse CEOs, make more conservative corporate decisions and have a lower leverage ratio which is supported by Faccio et al. (2016) study. In our research, however, we study the reverse effect for leverage ratio. Indeed, we test whether the lower leverage ratio increases the probability of the CEO to be female.

Hypothesis 2:

"Female CEOs are less risk seeking than male CEOs. Consequently, lower leverage ratio increases the probability of a female to become the CEO."

3.3. Female Directors Presence on Board and CEO Gender

The recent research mostly agrees that there is a positive relationship between the presence of female directors on board of directors and the representation of female executives. Bilimoria (2006), Soares et al. (2012), Amore et al. (2014), Matsa & Miller (2011), and Elkinawy & Stater (2011) empirically supported the notion that the probability of having a female CEO in the firm increases with the percentage of female directors increase. It leads us to the next hypothesis we would like to test for the Norwegian companies.

Hypothesis 3:

"*The fraction of female directors on a corporate board will be positively associated with the probability of the CEO to be female."*

3.4. Ownership Types and CEO Gender

The literature on the firm ownership impact on CEO gender is quite scarce. Most of the research is related to the listed companies. Listed and long-established companies do not tend to have female CEOs (Morikawa, 2014). We can rely on the papers suggesting that state and family owned companies tend to assign female CEOs (Bohdanowicz, 2015; Bjuggren et al., 2015). Importantly, we should take into account the quota law in Norway that resulted in the relatively higher increase of female CEOs in listed than in family firms according to the data observations.

On the contrary, Eklund et al. (2009) showed that ownership concentration does not affect board size or board composition. All these works are unique and are not supported by numerous research papers, which might be due to complicated data gathering.

We have data on all ownership types for Norwegian companies, including international ownership, institutional ownership, family ownership, personal ownership, and CEO belonging to the family data. Therefore, we can test all these factors influence on the CEO gender and construct several hypotheses.

Hypothesis 4.1:

"State ownership has positive impact on the female CEO appointment."

Hypothesis 4.2:

"Female CEOs are more likely to be appointed in the family owned firms."

Hypothesis 4.3:

"The probability of a female CEO appointment is higher in the firms owned by institutional investors."

Hypothesis 4.4:

"International ownership does not influence the CEO gender."

Hypothesis 4.5:

"If a CEO is a family member, it is more likely that it will be a female."

3.5. Company Size and CEO Gender

The researchers agree that size of the company is an important control variable. We use the number of employees as the size variable. However, it is also interesting if it can be an independent factor that itself influences significantly the CEO gender.

The recent papers mostly discuss the positive influence of the firm size on the number of female directors. This can be tested also for the impact on CEO gender. Moreover, Parotta & Smith (2013a) found that companies with a female CEO tend to be larger than the full sample. Therefore, it will be consistent for us to offer another hypothesis for the Norwegian companies.

Hypothesis 5:

"The larger the size of the company the higher is the probability of a CEO being a female."

3.6. The Quota Law Influence on CEO Gender in Norway

The quota policy effectiveness has been debated since the research indicated that while women participation has increased, senior positions remain restricted to men (Seierstad et al., 2010). Still, we want to check whether the quota policy treatment increased the probability of females being CEOs. We will test it for different ownership types.

Hypothesis 6:

"The quota policy influenced positively the CEO gender change from male to female.

Methodology

The methodology for the thesis is based on estimating the impact of different characteristics on CEO gender through logit model analysis and a difference-in-difference analysis. We conducted the analysis in STATA. The difference-indifference analysis has been performed to compare how the Quota Law treatment influenced CEO gender for different ownership types of companies. In this section, we describe the models we used to investigate our research question.

4.1. Conditional Logistic Regression

Logistic regression is the appropriate regression analysis to conduct when the dependent variable is dichotomous (binary), as in our case it is CEO gender. Like all regression analysis, the logistic regression is a predictive analysis. This model is used to describe data and to explain the relationship between one dependent binary variable and nominal, ordinal, interval, or ratio-level independent variables.

Our data set is an unbalanced panel data. Therefore, we should make panel logistic regressions to determine the relationships between the firm characteristics and CEO gender. Furthermore, when we have panel data, another alternative presents itself: we can use the subjects as their own controls (Allison, 2009). With binary dependent variables, this can be done using of conditional fixed effects logistic regressions. With panel data we can control for stable characteristics, i.e. characteristics that do not change across time, whether they are measured or not. This does not control for time-varying variables, but such variables can be explicitly included in the model, e.g. employment status, income.

First, the linear combination of explanatory variables is defined, also in vectorial form.

$$V_{it,j} = \alpha_j + \beta_1 x_{1it.j} + \beta_2 x_{2it,j} + \cdots + \beta_n x_{nit,j} = x'_{it}\beta_j$$

To estimate the model parameters β (the coefficients of the linear function), it seeks to maximize the likelihood function. Unlike linear regression, an exact analytical solution does not exist. It is therefore necessary to use an iterative algorithm. The probabilities are calculated.

$$Prob(y_{it} = j) = \pi_{it} = \frac{\exp(V_{it,j})}{\sum_{k-1}^{c} \exp(V_{it,k})}$$

The β coefficients are interpreted as proportional changes in the odds ratios. Therefore, in terms of interpreting the coefficients, it is helpful to have the odds ratios.

$$\ln \frac{Prob(y_{it} = j)}{Prob(y_{it} = c)} = V_{it,j} - V_{it,c} = x'_{it}\beta_j$$

$$Odds = \frac{Prob(y_{it} = j)}{Prob(y_{it} = c)}$$

To estimate the influence of every firm characteristic that we base our hypotheses on we would run different regressions. We have grouped the data according to the hypotheses. We run conditional fixed or random effects logistic regressions for every group of factors to calculate the probability (odds) of the CEO being female.

4.2. Fixed and Random Effects Regressions

While it is possible to use ordinary multiple regression techniques on panel data, they may not be optimal. The estimates of coefficients derived from regression may be subject to omitted variable bias. With panel data, it is possible to control for some types of omitted variables by observing changes in dependent variable over time. These controls for omitted variables differ between cases but are constant over time. It is also possible to use panel data to control for omitted variables that vary over time but are constant between cases.

Fixed effects regression is the model used to control for omitted variables that differ between cases but are constant over time. It allows using the changes in variables over time to estimate the effects of regressors on dependent variable, and is the main technique used for panel data analysis (Torres-Reyna, 2013).

Fixed effects regression is used when the only interest is analysing the impact of variables that vary over time. It explores the relationship between predictor and outcome variables within an entity (country, person, company, etc.). Each entity has its own individual characteristics that may or may not influence the predictor variables. When using fixed effects regression, we assume that something within the individual may affect or bias the predictor or outcome variables and we need to control for this. This is the rationale behind the assumption of the correlation between entity's error term and predictor variables.

Fixed effects remove the effect of those time-invariant characteristics so we can assess the net effect of the predictors on the outcome variable. Another important

assumption of the fixed effects model is that those time-invariant characteristics are unique to the individual and should not be correlated with other individual characteristics. Each entity is different, therefore the entity's error term and the constant (which captures individual characteristics) should not be correlated with the others. If the error terms are correlated, then fixed effects model is not suitable since inferences may not be correct and it is required to model that relationship (probably using random-effects).

The rationale behind random effects model is that, unlike the fixed effects model, the variation across entities is assumed to be random and uncorrelated with the predictor or independent variables included in the model. If differences across entities have some influence on dependent variable then random effects should be used. Random effects assume that the entity's error term is not correlated with the predictors, which allows time-invariant variables to play a role as explanatory variables. In random effects, those individual characteristics that may or may not influence the predictor variables need to be specified.

An advantage of random effects model is the possibility to include time invariant variables (i.e. gender). In the fixed effects model these variables are absorbed by the intercept. The problem with this is that some variables may not be available; therefore, leading to omitted variable bias in the model. Random effects model allows generalizing the inferences beyond the sample used in the model (Torres-Reyna, 2013).

4.3. Hausman Test

The generally accepted way of choosing between fixed and random effects is running a Hausman test, where the null hypothesis is that the preferred model is random effects vs. the alternative fixed effects. It tests whether the unique errors are correlated with regressors (Erickson & Rothberg (Eds.), 2016).

Statistically, fixed effects are always a reasonable thing to do with panel data (they always give consistent results) but they may not be the most efficient model to run. Random effects will give better p-values, as they are a more efficient estimator, so they should be run if it is statistically justifiable to do so.

The Hausman test has the null hypothesis that the coefficients estimated by the efficient random effects estimator are the same as the ones estimated by the consistent fixed effects estimator. If they are, then it is safe to use random effects.

If we get a significant p-value, however, we should use fixed effects (Hausman, 1978).

The Hausman test checks a more efficient model against a less efficient but consistent model to make sure that the more efficient model also gives consistent results. To run a Hausman test comparing fixed with random effects, we first estimated the fixed effects model, saved the coefficients and compared them with the results of the random effects model, and then did the comparison (Hausman, 1978).

4.4. Models Specifications

Every regression we run twice: with both fixed and random effects. We choose the final specification after doing the Hausman test. The dependent variable is the CEO gender dummy variable. For every regression, after the linear combination of explanatory variables is defined, we calculate the probability and the odds ratio of the CEO being a female. If the CEO gender is female, y_{it} =1.

$$Prob(y_{it} = 1) = \pi_{it} = \frac{\exp(V_{it,j})}{\sum_{k-1}^{c} \exp(V_{it,k})}$$

$$Odds = \frac{Prob(y_{it} = 1)}{Prob(y_{it} = 0)}$$

4.4.1. Lagged firm performance, lagged leverage usage and CEO gender

In order to estimate the firm performance and leverage usage influences on the CEO gender, we run a conditional logistic regression with fixed effects using lagged return on assets ($ROA_{it-1,j}$), leverage ratio as debt-to-equity ratio ($Lev_{it-1,j}$), and company size in terms of natural logarithm of revenue ($Logrev_{it-1,j}$) variables. Then we calculate the probability and the odds ratio of the CEO being a female. We also run the regressions with time, industry and both as control variables.

$$V_{it,j} = \alpha_j + \beta_1 ROA_{it-1,j} + \beta_2 Lev_{it-1,j} + \beta_3 Logrev_{it-1,j}$$

$$V_{it,j} = \alpha_j + \beta_1 ROA_{it-1,j} + \beta_2 Lev_{it-1,j} + \beta_3 Logrev_{it-1,j} + \beta_4 Year_{it,j}$$

$$V_{it,j} = \alpha_j + \beta_1 ROA_{it-1,j} + \beta_2 Lev_{it-1,j} + \beta_3 Logrev_{it-1,j} + \beta_4 Ind_{it,j}$$

$$V_{it,j} = \alpha_j + \beta_1 ROA_{it-1,j} + \beta_2 Lev_{it-1,j} + \beta_3 Logrev_{it-1,j} + \beta_4 Year_{it,j} + \beta_5 Ind_{it,j}$$

4.4.2. The Fraction of Female Directors and CEO Gender

In accordance with Billimoria (2006) research, we also check whether the female directors percentage has a significant impact on the CEO gender. Here we use the variables on board size ($BS_{it,j}$), percentage of female directors on board ($Proportion_{it,j}$), number of employees ($NE_{it,j}$), company size in terms of revenue ($Logrev_{it,j}$), time ($Year_{it,j}$), and industry ($Ind_{it,j}$).

$$V_{it,j} = \alpha_j + \beta_1 Proportion_{it,j} + \beta_2 BS_{it,j} + \beta_3 Logrev_{it,j} + \beta_4 NE_{it,j}$$

$$V_{it,j} = \alpha_j + \beta_1 Proportion_{it,j} + \beta_2 BS_{it,j} + \beta_3 Logrev_{it,j} + \beta_4 NE_{it,j} + \beta_5 Year_{it,j}$$

$$V_{it,j} = \alpha_j + \beta_1 Proportion_{it,j} + \beta_2 BS_{it,j} + \beta_3 Logrev_{it,j} + \beta_4 NE_{it,j} + \beta_5 Ind_{it,j}$$

$$V_{it,j} = \alpha_j + \beta_1 Proportion_{it,j} + \beta_2 BS_{it,j} + \beta_3 Logrev_{it,j} + \beta_4 NE_{it,j} + \beta_5 Year_{it,j} + \beta_6 Ind_{it,j}$$

4.4.3. Ownership types and CEO gender

For all ownership types in our sample, we run conditional logistic regression with fixed effects with CEO gender as dependent variable. The independent variables are firm aggregate fractions owned by institutional ($Ins_{it,j}$), family ($Fam_{it,j}$, 100% family owned), state ($State_{it,j}$), and international owners ($Int_{it,j}$); the share owned by CEO ($CEO\_sh_{it,j}$), percentage of equity held by ultimate owners with the highest rank ($Equity_{it,j}$), largest family has CEO ($Fam\_CEO_{it,j}$), aggregated fraction held by personal owners ($Personal_{it,j}$). Time ($Year_{it,j}$) and industry ($Ind_{it,j}$) are control variables. Then we calculate the probability and the odds ratio of the CEO being a female.

$$V_{it,j} = \alpha_j + \beta_1 State_{it,j} + \beta_2 Int_{it,j} + \beta_3 Ins_{it,j} + \beta_4 CEO\_sh_{it,j} + \beta_5 Equity_{it,j} + \beta_6 Fam_{it,j} + \beta_7 Fam\_CEO_{it,j} + \beta_8 Personal_{it,j}$$

$$V_{it,j} = \alpha_j + \beta_1 State_{it,j} + \beta_2 Int_{it,j} + \beta_3 Ins_{it,j} + \beta_4 CEO\_sh_{it,j} + \beta_5 Equity_{it,j} + \beta_6 Fam_{it,j} + \beta_7 Fam\_CEO_{it,j} + \beta_8 Personal_{it,j} + \beta_9 Ind_{it,j}$$

$$V_{it,j} = \alpha_j + \beta_1 State_{it,j} + \beta_2 Int_{it,j} + \beta_3 Ins_{it,j} + \beta_4 CEO\_sh_{it,j} + \beta_5 Equity_{it,j} + \beta_6 Fam_{it,j} + \beta_7 Fam\_CEO_{it,j} + \beta_8 Personal_{it,j} + \beta_9 Year_{it,j}$$

$$V_{it,j} = \alpha_j + \beta_1 State_{it,j} + \beta_2 Int_{it,j} + \beta_3 Ins_{it,j} + \beta_4 CEO\_sh_{it,j} + \beta_5 Equity_{it,j} + \beta_6 Fam_{it,j} + \beta_7 Fam\_CEO_{it,j} + \beta_8 Personal_{it,j} + \beta_9 Ind_{it,j} + \beta_{10} Year_{it,j}$$

4.4.4. All firm`s characteristics and CEO gender

Finally, we use all available independent and control variables for the regression.

$$V_{it,j} = \alpha_j + \beta_1 BS_{it,j} + \beta_2 NE_{it,j} + \beta_3 Proportion_{it,j} + \beta_4 Lev_{it-1,j} + \beta_5 ROA_{it-1,j} + \beta_6 Logrev_{it-1,j} + \beta_7 Fam\_CEO_{it,j} + \beta_8 Personal_{it,j} + \beta_9 State_{it,j} + \beta_{10} Int_{it,j} + \beta_{11} Ins_{it,j} + \beta_{12} CEO\_sh_{it,j} + \beta_{13} Equity_{it,j} + \beta_{14} Fam\_largest_{it,j} + \beta_{15} Ind_{it,j} + \beta_{16} Year_{it,j}$$

4.5. Difference-in-Difference Analysis

We conduct the difference-in-difference analysis to test if the quota policy had a significant effect on the CEO gender.

Difference-in-difference analysis is a quasi-experimental design that uses longitudinal data from treatment and control groups to obtain an appropriate counterfactual to estimate a causal effect (Columbia University Mailman School of Public Health, 2017). Difference-in-difference analysis is typically used to estimate the effect of a specific intervention or treatment (such as a passage of law, enactment of policy, or large-scale program implementation) by comparing the changes in outcomes over time between a population that is enrolled in a program (the treatment group) and a population that is not (the control group).

Difference-in-difference analysis is used in observational settings where exchangeability cannot be assumed between the treatment and control groups. It relies on a less strict exchangeability assumption, i.e., in absence of treatment, the unobserved differences between treatment and control groups are the same overtime. Hence, difference-in-difference analysis is a useful technique when randomization on the individual level is not possible. It requires data from pre- and post-treatment periods, such as panel data (individual level data over time) or repeated cross-sectional data (individual or group level). The approach removes biases in post-treatment period comparisons between the treatment and control group that could be the result from permanent differences between those groups, as

well as biases from comparisons over time in the treatment group that could be the result of trends due to other causes of the outcome (Columbia University Mailman School of Public Health, 2017).

The difference-in-difference analysis allows us to compare and evaluate if the quota policy made differences in firms CEO`s gender. In this analysis, we examine the event group that is exposed to the treatment, which in our case are the firms of different ownership types being exposed to the Quota Law. The other group is the control group, which in our case are these firms before the policy implementation.

To get the difference-in-difference estimator we first generate the time horizon for the groups exposed to treatment. It is after 2006, when the quota policy was strictly implemented. Then we generate the variables for the treated groups. We have four treated groups according to the ownership types: family firms, institutionally owned firms, internationally owned firms, and state owned firms. The above-mentioned variables are both dummy variables. Then we generate the difference-in-difference estimators for every group and run the regressions for every group as follows:

$$y_{i,t} = \beta_0 + \beta_1 TQ_t + \beta_2 TG_i + \beta_3 DiD_{i,t} + \varepsilon_{i,t}$$

In the regression, $y_{i,t}$ is the CEO gender change. If $y_{i,t} = 1$, the change was male to female CEO, otherwise it was female to male. The dummy variable TG_i accounts for possible differences between the treated and control group. If the firm belongs to the treated groups – family firms, institutionally owned firms, internationally owned firms, and state owned firms – it will be captured by the dummy variable TG_i being equal to one, and for other firms it will be zero. TQ_t is a dummy variable indicating the time of quota policy. It will be equal to one if the observation is in the quota treatment period and zero otherwise. We are interested in difference-in-difference estimators $DiD_{i,t}$, which are captured by the coefficients β_3 and attained by ordinary least squares estimation method. The values of the coefficients show that the treatment had either a positive or a negative effect on the CEO gender being female, or that it was insignificant.

Data

The data for our thesis is obtained from the Centre for Corporate Governance Research (CCGR) database at BI Norwegian Business School. This database gives access to both accounting and corporate governance data for Norwegian firms over the period 1994-2015. The Norwegian law mandates firms to publish an audited report each year. The report includes all financial statements as well as board of directors' report and the auditor's report. The firm is also obliged to publish the identity of CEO and board of directors and the fraction of equity held by every owner (Berzins, Bohren, & Ryndland).

For our empirical analysis, we got access to 20 variables from CCGR database shown in table 5.1 (see appendices). The original sample was a large panel data set over the period from 2000 to 2014 with roughly 3.2 million firm-year data. As the original sample included missing values and meaningless values for our analysis, negative debt, sales, assets, etc., we applied 16 filters to achieve a meaningful inference to perform a consistent analysis. The list of filters with their effect on the sample size is in the table 5.2.

As the topic indicates, the main variable in our analysis is "CEO gender", which is the dependent variable in our regression models. Due to its importance, we applied the first filter to keep firms with meaningful values in "CEO gender". Furthermore, as firms with zero fixed assets are mainly individuals providing few services over a year without having firm property, they are not functioning as a firm. Therefore, we applied the second filter to exclude them from the data sample.

We applied filters 3-7, 9, and 16 to exclude missing values for different variables. The motivation was to achieve a consistent inference. Moreover, the meaningful values for these items were required to define the logistic regressions variables such as return on assets, leverage ratio in terms of debt-to-equity ratio, and the fraction of female directors. Filters 11 and 12 were also applied to achieve this goal. Besides, very small firms, firms with one employee, firms with no employees, and extreme outliers (1%) for return on assets and leverage ratio were trimmed using filters 8, 13, and 14 to omit possible bias in our sample.

Table 5.2: Dataset Filtering

The table presents the applied filters on the original data set to achieve a meaningful inference. The first column presents filter number, there were 16 filters which were applied in sequence from 1 to 16 as table shows. The second column gives the filter explanation. The third and fourth columns display the number of remained observations and the number of excluded observations after applying a filter, respectively.

Original Panel Data set		**3,162,073**	
Filter Number	**Filter Explanation**	**All Observations**	**Excluded Observations**
1	Exclude firms with missing values in CEO gender variable.	2,337,542	824,531
2	Exclude firms with zero total fixed assets.	1,962,574	374,968
3	Exclude firms with missing values in total current assets.	1,962,549	25
4	Exclude firms with missing values in total equity.	1,962,548	1
5	Exclude firms with missing values in board size.	1,891280	71,268
6	Exclude firms with missing values in share owned by CEO.	1,059,971	831,309
7	Exclude firms with missing values in largest family has CEO.	1,059,804	167
8	Exclude firms with 0, 1, & missing values in number of employees.	506,762	553,042
9	Exclude firms with missing values in industry codes.	491,727	15,035
10	Exclude firms with multiple industry codes.	464,197	27,530
11	Exclude firms with negative total debt and total assets.	464,061	136
12	Exclude firms with missing and negative values in leverage ratio (negative total equity).	404,152	59,909
13	Exclude firms within 1% of upper and lower quantile of ROA.	396,066	8,086
14	Exclude firms within 1% of upper and lower quantile of leverage ratio.	387,953	8,113
15	Exclude firms with less than 4 years firm year data.	323,322	64,631
16	Exclude firms with missing values in log Revenue.	315,003	8,319

In CCGR database, all firms are classified according to the North American Industry Classification System (NAIC industry codes). For consistency, we excluded the firms with multiple industry codes for a year from our sample. Finally, as the analysis required previous period values for accounting variables and realizing the CEO gender change, we kept firms with more than 3 years firm year data and eliminated the rest. After applying the above-mentioned filters, the final sample was an unbalanced panel data set with 315,003 firm year observations for 40,880 firms over 15 years, 2000-2014.

5.1. Data Variables

Apart from the CCGR variables, we need to define three more variables for the empirical analysis. These variables include firm performance, capital structure, and board of directors' structure in terms of return on assets, leverage ratio, and board of directors composition, respectively.

5.1.1. Firm Performance

In the first part of our analysis, we estimate the effect of financial performance on CEO gender, which requires a proper measure. There are different metrics measuring firm performance, however, we chose return on assets (ROA) since it has a better view on the business fundamentals. ROA is a measure of how profitable a company is according to its assets. It is defined as follows:

$$ROA = \frac{EBTI \times (1 - tax\ rate)}{Total\ Assets}$$

ROA explicitly takes into account the amount of assets used to support business activities. It determines whether the company is able to generate an adequate return on its assets (Hagel, Brown, & Davison, 2010). According to the formula and the given variables in our sample, we define ROA for our analysis as follows:

$$ROA = \frac{Income\ Before\ Extraordinary\ Items}{Total\ Current\ Assets + Total\ Fixed\ Assets}$$

5.1.2. Capital Structure

Companies finance their activities using two sources, debt and owner's equity. The capital structure shows how a company mixes these sources to finance its operations. The main measure for capital structure is "Leverage Ratio" assessing a company's ability to meet its obligations. The most well-known leverage ratio is debt-to-equity ratio, which is formulized as follows where total debt is the sum of both short-term and long-term liabilities:

$$\text{Leverage Ratio} = \frac{Total\ Debt}{Total\ Equity}$$

A high leverage ratio means the firm is mainly financed by debt in terms of different liabilities and causes high credit risk of the company. In the related literature for our topic, firms with female CEO tend to have a lower leverage ratio because of the CEO risk aversion (Faccio et al., 2016). On the other hand, in our study we focus on the effect of this measure on CEO gender decision.

5.1.3. Board of Directors Composition

According to Berns & Klarner (2017), one of the important factors in CEO succession decisions is board of directors' composition and preferences. Therefore, we were interested to study the relation between the board composition, specifically

the fraction of females on board, and CEO gender. We measure this fraction as follows:

$$Fraction\ of\ Female\ Directors = \frac{Number\ of\ Female\ Directors}{Board\ Size}$$

For simplicity, we use this measure in percent in our study.

5.1.4. Company size

We use two alternative variables for company size: number of employees and company size in terms of revenues, which is calculated as follows:

$$Company\ size\ (revenues) = Logrev = \ln(revenues)$$

5.2. Descriptive Statistics

To have a better insight of the difference between firms with CEOs of either gender, we conducted a descriptive analysis on our data sample. The filtered sample included 315,003 firm-year data over the period of 2000-2014 for 40,880 firms. The fraction of firms with female CEOs was 15.81% of the whole sample, while 84.19% of firms had male CEOs.

The descriptive analysis includes four main parts (tables 5.3-5.6 and graphs 5.1-5.3). In the first part, we analyse the descriptive statistics of the overall sample in addition to both firms with female CEOs and firms with male CEOs. Mean, median, and the mean difference test t-statistics for the whole sample and the firms with CEOs of either gender are replicated in table 5.3 (see appendices).

The table 5.3 shows the mean and median for 17 variables which we explain in detail below.

5.2.1. Board size

"Board size" variable is presented as the number of members in a firm`s board of directors. As table 5.3 replicates, the average board size for the whole sample is 2.13 with median 2 meaning that 50% of firms have board size smaller or equal to 2. Therefore, we can conclude that the whole sample includes firms with small board of directors. For the groups of firms with CEOs of either gender the median is the same and is equal to 2. The average is 2.14 for firms with male CEOs and 2.09 for firms with female CEOs stating a minor difference between these two groups in board size. However, the mean difference test with 95% confidence

interval (see appendices, table 5.3) shows a significant difference in board size for these groups.

5.2.2. Company Size

As table 5.3 (see appendices) shows, the average "number of employees" for the whole sample is 7.97. Besides, 50% of firms have 5 or less than 5 employees. Although the maximum number of employees is 728, the mean and median assert the sample contains small firms in terms of number of employees.

The results for firms with male and female CEOs replicate they have a major deviation from each other in the average number of employees, 8.18 and 6.83, respectively. The mean difference test confirms there is a highly significant difference between these two groups. However, the median is the same and equal to 5. According to these results, firms with female CEOs have smaller number of employees than firms with male CEOs.

Moreover, for the company size in terms of revenue variable "Logrev" we see that the whole sample has an average of 15.53 with half of the firms having size less than or equal to 15.5. Comparing two groups of firms with CEOs of either gender, we realize a difference between their average size in terms of logarithm of revenue which is highly significant (table 5.3, appendices). These statistics show firms with male CEO have a larger size in sales than firms with female CEO.

5.2.3. Fraction of Female Directors

In the sample data, the "Fraction of female directors" has an average of 18.32 %. Table 5.3 (see appendices) shows that 50% of firms have no female directors on their board. Moreover, results from the separated groups of firms with either CEO genders show a significant difference in the average values of this fraction, 8.98% and 68.06% for firms with male and female CEOs, respectively. There are two possible explanations for this difference. First, firms with female CEOs assign more female directors to their boards of directors. Second and related to our study, for a board of directors with high fraction of female members it is more probable to choose a female CEO.

However, these results are for the whole sample period, 2000- 2014. It was interesting to find these statistics for the years after Gender Quota Law legislation in Norway, 2004 (see appendices, table 5.3). The average of female proportion in

firms' boardroom had a small increase after 2004, 19.07%, 9.12%, and 68.47% for the whole sample and firms with male and female CEOs, respectively. Hence, even after gender quota law the average fraction of female directors is significantly different between two groups.

5.2.4. Total Assets

Table 5.3 (see appendices) shows that the average of "Total assets" for the whole sample is 5,898,321 NOK with 50% of observations having 2,684,000 NOK or less total assets. This average is 6,389,578 NOK for firms with male CEO and 3,281,636 NOK for those with female CEO. Besides, firms with male and female CEOs have 50% of their total assets equal or less than 2,960,000 NOK and 1,572,000 NOK, respectively. Clearly, these numbers show a considerable difference between these two groups in total assets, which is proved to be significant in the same table.

To have a closer look on this difference we compared total equity and total debt for firms with CEOs of either gender. As we see in table 5.3 (see appendices), the differences are clear and significant in average total equity and debt. According to these results, we can assume that the firms with male CEOs tend to have higher total assets than the firms with female CEOs.

5.2.5. Return on Assets

As explained above, ROA measures firm performance. As table 5.3 shows (see appendices), the average Return on Assets for the data sample is 9.39% with 50% of firms having ROA equal or less than 8.22%. Comparing firms with either CEO gender, we see firms with male CEOs have a better performance than those with female CEO on average, 9.49% and 8.85%, respectively. According to the test result, this difference is significant.

5.2.6. Leverage Ratio

"Leverage ratio" conveys important information about capital decision making and degree of risk-taking in a firm. The sample average leverage ratio, debt-to-equity ratio, is 4.32 while half of the observations has equal or less than 2.57 for this metric. The existing deviation of mean from median can be explained by presence of outliers. It is good to point out that we have already excluded 1% outliers for the leverage ratio.

For our groups of interest, firms with male and firms with female CEOs, the average is 4.32 and 4.30, respectively, with very close median values. As table 5.3 (see appendices) replicates, this difference is insignificant. We conclude from this insignificant difference that gender does not affect firm capital decision making much and male and female CEOs both tend to set the structure similar.

5.2.7. Ownership structure

The ownership related variables are presented in aggregated fraction form and include institutional owners, state owners, international owners, and personal owners. Moreover, we had female owners variable in the data sample which did not have any non-zero observations after applying the filters. As table 5.3 presents (see appendices), the main ownership type of Norwegian firms is personal ownership. Personal owners have the highest fraction for the whole sample and both male and female managing firms. We should mention that in the CCGR database there are three other groups of owners in aggregated fraction style which are not included in our data sample.

To be more specific in comparison of the firms with female and male CEOs, we assess ownership groups separately. First, institutional owners have a very small fraction in ownership in the whole sample and two groups (see appendices, table 5.3). Besides, the mean difference test shows an insignificant difference in average of this variable for firms with CEOs of either gender. Therefore, we can conclude that having an institutional owner does not have anything to do with CEO gender.

The second presented ownership type is state ownership (see appendices, table 5.3). The aggregated fraction of state or public ownership has the averages of 0.066, 0.068, and 0.052 for the whole sample, firms with male CEO, and firms with female CEO, respectively. Furthermore, half of the observations is 0 for all three groups, which means Norwegian state owners do not have ownership over the majority of firms. However, there is a significant difference between the averages of firms with CEOs of either gender: the firms with male CEO have the higher aggregated fraction. According to this difference, we can say firms with male CEOs tend to have a higher fraction of state owners.

The next ownership type is international ownership. Although international owners have a higher aggregated fraction compared to the already mentioned ownership types, they still have a small fraction in general and in both CEO gender groups.

Dividing the sample into two groups of firms with male and female CEOs and assessing this ownership type reveals a difference between the two groups. They have the average of 0.44 and 0.39 for male CEOs and female CEOs, respectively, these averages are deviated from each other and have a statistically significant difference. For international owners we can make the same conclusion as for the state owners.

Finally, the last ownership type is personal ownership. This type has the highest average aggregated fraction among the others. The average of aggregated fraction held by personal owners for the whole sample and groups of firms with male CEO and female CEO is 95.9, 95.75, and 96.68, respectively. The median is 100 for the whole sample and both groups saying more than half of observations have solely personal owners. Additionally, as table 5.3 (see appendices) shows, there is a significant difference between firms with male and female CEOs. The later one has a higher personal ownership fraction and we can assume that firms with high fraction of personal ownership tend to have female CEO more than other firms do.

The next ownership related variable is the share owned by CEO. The data sample has an average of 63.65% with half of the observations less than or equal to 54.91%. It shows that more than half of the sample has at least a 50% share owned by CEO. The comparison of our groups of interest presents a significant difference between them. Male CEOs have a higher share ownership than female.

5.2.8. Family firms

We have two family firms` related variables in our data set, “Largest family sum ultimate ownership” in percent and “Largest family has CEO” as a binary variable (1 if the largest family has CEO and 0 otherwise).

As table 5.3 shows (see appendices), the averages of “The largest family sum ultimate ownership” variable for the whole sample and two groups of interest are high, 79%, 78.73%, and 80.44% for the whole sample, firms with male, and firms with female CEOs, respectively. The half of observations for all groups has complete ownership by the largest family. This statistics shows that for the majority of family firms the largest family has 100% ownership and for the rest this ownership is high but not complete. We also see that firms with female CEOs have a higher average for this variable, which is significantly different from the firms

with male CEO average. We conclude that the largest family has a higher ownership than other firms do in firms with female CEOs.

In addition to the ownership of largest family, we have the "Largest family has CEO" variable in the dataset. It has high averages for the sample and firms with CEOs of either gender. It also has median equal to 1 for all groups meaning half firms in the whole sample and both groups have more than 50% of largest firms as managing firm. After comparing the average of firms with male and female CEOs, we have to admit that they differ significantly and the later one has a lower average. We can say the largest firms tend to assign male CEOs more than female ones.

5.3. Summary of Descriptive Statistics

5.3.1. Whole data sample

The sample includes data for 40,880 firms over 15 years, 2000-2014. According to table 5.3 (see appendices), columns 2 and 3, it contains small firms in number of employees, small boards of directors with low fraction of female directors, both whole sample and the sample after 2004. Furthermore, firms have a high average of total assets, relatively high leverage ratio, and clearly high aggregated fraction held by personal owners.

5.3.2. Comparing Firms with CEOs of either Gender

We divided the sample into two main groups, firms with male CEOs and those with female CEOs. There are 265,212 firms with male and 49,791 firms with female CEOs in our sample. Referring to the last column of table 5.3 (see appendices), there are several significant differences between these two groups.

Summarizing these differences, female CEOs on average tend to manage smaller firms with smaller boards and a better gender-diversified board of directors. They also tend to have lower amount of total assets on average. They seem to have a weaker financial performance in terms of return on assets and have a lower ownership in firm's share compared to male CEOs. In ownership structure, they are significantly different from the firms with male CEOs. Female CEOs managing firms tend to be owned more by personal owners and less by public and international owners.

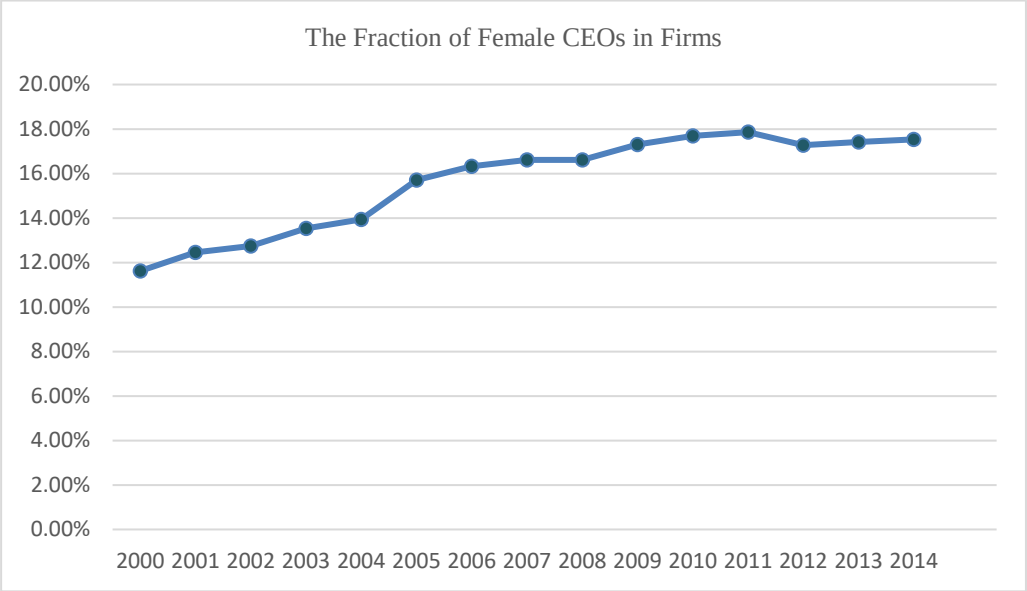
5.3.3. The number of Female CEOs over time

Table 5.4 (see appendices) and graph 5.1 replicate statistics related to the number of female CEOs over the sample period, 2000-2014.

Since we had an unbalanced panel data set, we had different number of firms for each year. Accordingly, we calculated the fraction of female and male CEOs in percent for each year, table 5.3 (see appendices). Graph 5.1 visualizes this fraction. According to graph 5.1, there is a general upward trend in the fraction of female CEOs in the sample over 15 years. The highest positive change is about 2% and happened in 2005. We can assume this is the effect of Gender Quota Law legislation in 2004.

Graph 5.1: The fraction of Female CEOs.

This graph displays the fraction of female CEOs in firms for each year over the sample period, 2000-2014. The fraction is calculated as the number of female CEOs in a year divided by the total number of firms.



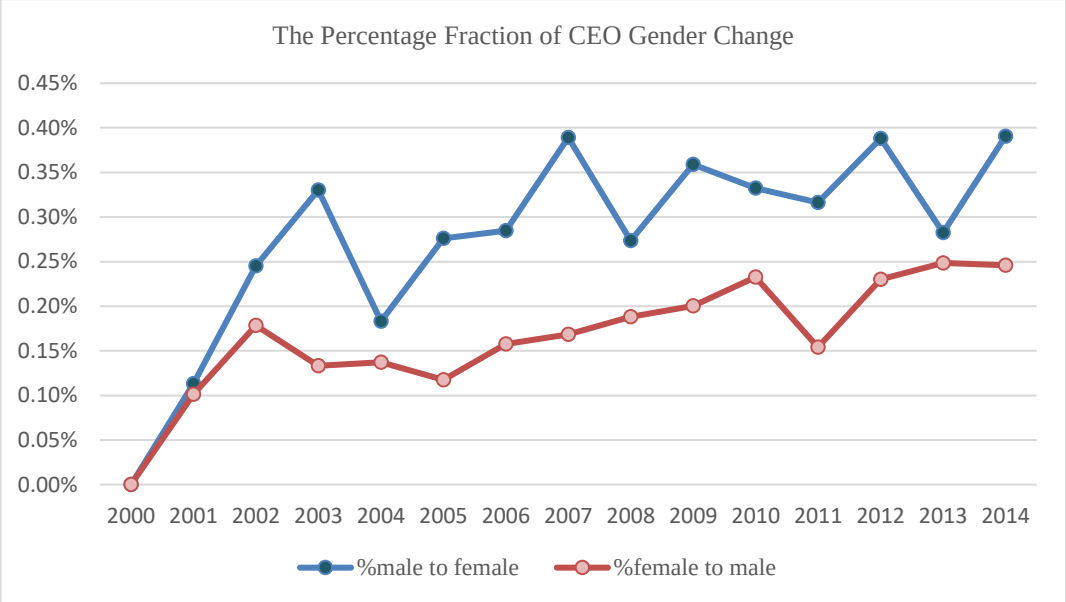
5.3.4. CEO Gender Change over time

In our data set, we were also interested to check for the number of changes from male to female CEOs. We looked at changes from male to female and female to male CEOs in the sample firms. To achieve a reliable inference, we calculated the percentage fraction of CEO gender changes for each year (graph 5.2).

Table 5.5 (see appendices) and graph 5.2 present the numbers and fractions of changes. No trend is detected according to graph 5.2 for neither male to female nor female to male CEO gender changes. However, in general, the fraction of changes from male to female is always higher over the period of the sample.

Graph 5.2: The Fraction of CEO Gender Change.

This graph presents the fractions of CEO Gender change in percent for each year over the sample period, 2000-2014. The % fraction of change is replicated in two colors and represents two groups of changes. The blue line shows the fractions of male to female changes and the orange line shows female to male changes in CEO gender. For each year these fractions are calculated as the number of changes divided by the total number of firms in the year.



5.3.5. Industry classifications and CEO Gender

Industry type has a high importance in our study since the existing literature states that female CEOs are assigned more in firms in customer goods or media industries (Ibarra & T. Hansen, 2009). Accordingly, to check for it, we studied industry classifications in our sample. All firms in our dataset were classified with a five-digit industry code. For simplicity, we kept the first 2 digits of codes to assess the sample and groups of CEOs of either gender industry type. We did our analysis in two parts. First, to check for industry proportions, we analysed the aggregated fraction of each industry in the sample (see appendices, graph 5.3). Second, we studied the fraction of firms with female CEOs and the fraction of firms with male CEOs for all industries. We studied these fractions to see which industries are female or male CEO dominant as shown in graph 5.4 and table 5.6 (see appendices).

As graph 5.3 shows (see appendices), the industries with two-digit codes 43, 45, 47, 52, and 74 have the highest representatives in the sample. These codes represent motor vehicle sections, transportation services, communications, retail, and construction industries, respectively. We find fraction of firms with CEOs of either gender in each industry in graph 5.4 (see appendices). As it displays, female CEOs

have a high fraction, higher than 50%, only in four industries. In general, female CEOs have 20% or higher fraction in 20 industries. The industry groups with highest female attendance are those with two-digit codes 75, 88, 93, and 95. These codes represent repair services, sports, social services, and veterinary services, respectively. Among the industries with the lowest number of female CEOs we have mining, support services for mining and oil, forestry, sewerage, and manufacturing of soft drinks. In general, we can conclude based on the results that the firms functioning in service industries tend to have more female CEOs. Besides, the manufacturing and more technical sectors tend to have more male CEOs.

Results and Analysis

In this section, we show our findings, discuss and interpret them. All calculations were performed in Stata. We conducted the conditional fixed effects logistic regressions for different firm`s characteristics that in our opinion might impact the CEO gender. The logistic regression is the most suitable analysis tool since the dependant variable is binary and its output is the odds ratio, which interpretation is a clear indicator whether we prove the hypotheses we expect to prove. The choice of model was obvious after performing the same regressions with fixed and then random effects and using Hausman test, as it is appropriate in our case. The tests presented in tables 6.1-6.4 (see appendices) showed that we should use the regressions with fixed effects. We are aware that this type of model allows a larger degree of freedom than the random effects model. Still, we are interested in the odds ratios and their significance and we are aware that there might be some effects that are omitted.

We conducted all the regressions as it was described in the methodology part – according to the groups of independent variables, then for all of them in one panel regression. Finally, we performed difference-in-difference analysis. The dependent variable was CEO gender for all regressions except the difference-in-difference analysis where the dependent variable was CEO gender change.

6.1. Firm Performance, Leverage Usage and CEO Gender

The models include 6,851 observations having 918 groups of unique observations. The software omits missing values automatically while running the logistic regression. Therefore, out of 315,003 observations of the whole sample we got less in the results of logistic regressions.

First, we ran the conditional logistic regression with fixed effects using lagged financial variables as independent variables (table 6.1.1). We used the first lag of each variable to show the influence of these factors on the next year CEO gender. The results of the regression showed that previous year`s leverage is statistically significant at 1% significance level as well as company size control variable, while return on assets is statistically significant at 10% significance level. The odds ratio indicates that the increase of leverage by one leads to 4% lower probability of CEO being a female rather than male next year. The same is true for return on assets. If ROA increases by one, the odds of CEO being a female are 40% lower next year.

On the other hand, the odds of CEO being a female would be 1.41 times higher if the size of the company increased. These findings support our hypotheses 1 and 5.

Table 6.1.1: Conditional Logistic Regression with Fixed Effects for Lagged Financial Variables

The table displays the results of conditional logistic regressions with fixed effects with CEO gender as the dependent variable. The independent variables are the first lags of ROA, leverage, and company size is used as control. The company size is calculated as natural logarithm of revenue. The standard errors are displayed in light grey and parenthesis under the coefficients. The significance levels are indicated as follows: * = 10%, ** = 5% and *** = 1%.

Independent and control variables	***Odds ratios***
Lagged leverage	0.9653***
	(0.007)
Lagged ROA	0.6025*
	(0.1751)
Lagged company size	1.4123***
	(0.1075)
Number of observations	6851
Number of groups	918
Observations per group (average)	7.5
Prob>chi^2	0.0000

Then, we ran the same regression but with time variable as control (table 6.1.2). The results of the regression showed that previous year`s leverage and company size are statistically significant at 10% and 5% significance level, respectively, while return on assets is non-significant. The odds ratio indicates that the increase of leverage by one leads to 2% lower probability of CEO being a female rather than male next year. The odds of CEO being a female also decrease by 16% if the company size increases. It might be due to controlling for time effects. All time variables except for year 2002 are statistically significant at the 1% level. The results show that the probability of CEO being a female increases in the later years, especially after 2006 when quota policy was implemented.

We also ran the same regression with industry variable as control (table 6.1.3). However, neither of the industries regression coefficients has statistically significant impact on the CEO gender. The previous year`s leverage and company size are statistically significant at 1% significance level while return on assets is non-significant. The odds ratio indicates that the increase of leverage by one leads to 3% lower probability of CEO being a female rather than male next year. The odds of CEO being a female are 1.26 times higher than being a male if the company size increases.

We used two-digit and one-digit industry codes and realized that neither have significant effects on the CEO gender.

Table 6.1.3: Conditional Logistic Regression with Fixed Effects and Industry Control for Financial Variables

The table displays the results of conditional logistic regressions with fixed effects with CEO gender as the dependent variable. The independent variables are the first lags of ROA, leverage, and company size is used as control. The company size is calculated as natural logarithm of revenue. The control variable is industry. The standard errors are displayed in light grey and parenthesis under the coefficients. The significance levels are indicated as follows: * = 10%, ** = 5% and *** = 1%. **All industries odds ratios are statistically insignificant at 10% level, therefore, not presented in the table.**

Independent and control variables	*Odds ratios*
Lagged leverage	0.9718***
	(0.007)
Lagged ROA	0.7721
	(0.2267)
Lagged company size	1.2632***
	(0.0983)
Number of observations	6851
Number of groups	918
Observations per group (average)	7.5
Prob>chi^2	0.0000

Finally, we ran the regression with both time and industry variables as controls (see appendices, table 6.1.4). The regression showed the same results as the conditional logistic regression with fixed effects and time control. The industry effects are all statistically insignificant.

6.2. Female Representation on the Board of Directors and CEO Gender

The models include 11,170 observations having 1,307 groups of unique observations. We ran the conditional logistic regression with fixed effects using board of directors size (number of directors on board), proportion of female directors, and firm size (number of employees and natural logarithm of revenue) as independent variables (table 6.2.1).

Table 6.2.1: Conditional Logistic Regression with Fixed Effects for Structural Variables

The table displays the results of conditional logistic regressions with fixed effects with CEO gender as the dependent variable. The independent variables are board of directors size, proportion of female directors, employees number, and company size (natural logarithm of revenue). The standard errors are displayed in light grey and parenthesis under the coefficients. The significance levels are indicated as follows: * = 10%, ** = 5% and *** = 1%.

Independent variables	*Odds ratios*
Board of directors	1.2174***
	(0.0515)
Percentage of female directors	1.0591***
	(0.002)
Number of employees	0.9936
	(0.0059)
Company size	1.4707***
	(0.0929)
Number of observations	11170
Number of groups	1307
Observations per group (average)	8.5
Prob>chi^2	0.0000

We used the proportion of female directors since the previous researchers, namely Billimoria (2006), used this variable rather than the number of female directors. The results of the regression showed that the more directors are on board the higher the probability of the CEO to be a female. Furthermore, higher percentage of female directors increases the odds of CEO gender to be female relative to male. The number of employees as firm size is non-significant. However, the odds ratio of the alternative company size variable – natural logarithm of revenue shows that its increase makes the probability of the CEO being a female higher. It proves that the firm size is significant variable and supports the previous research that we based our hypothesis 5 on.

Following the same analysis structure as with the financial variables, we ran the same conditional logistic regression with fixed effects and time control (see appendices, table 6.2.2). The odds of the CEO being a female rather than a male are 1.18 and 1.06 times higher if the board of directors and female directors' percentage, respectively, increase. The firm`s size is non-significant as both number of employees and natural logarithm of revenue show. All time variables are significant. Similar to the regression for financial variables with time control, the results show that the probability of CEO being a female increases in the later years, especially after quota policy implementation.

Then we got the results of the conditional logistic regression with fixed effects and industry control (table 6.2.3).

Table 6.2.3: Conditional Logistic Regression with Fixed Effects and Industry Control for Structural Variables

The table displays the results of conditional logistic regressions with fixed effects with CEO gender as the dependent variable. The independent variables are board of directors size, proportion of female directors, employees number, and company size (natural logarithm of revenue). The control variable is industry. The standard errors are displayed in light grey and parenthesis under the coefficients. The significance levels are indicated as follows: * = 10%, ** = 5% and *** = 1%. **All industries odds ratios are statistically insignificant at 10% level, therefore, not presented in the table**.

Independent and control variables	***Odds ratios***
Board of directors	1.2176***
	(0.0515)
Percentage of female directors	1.0591***
	(0.002)
Employees number	0.9936
	(0.0059)
Company size	1.4656***
	(0.0931)
Number of observations	11170
Number of groups	1307
Observations per group (average)	8.5
Prob>chi^2	0.0000

The odds of the CEO being a female rather than a male are 1.23 and 1.06 times higher if the board of directors and female directors' percentage, respectively, increase. The firm`s size has significant impact on the CEO gender according to natural logarithm of revenue variable. All industry variables odds ratios are statistically insignificant.

Last, we got the results of the conditional logistic regression with fixed effects, time and industry controls (see appendices, table 6.2.4). The probability of the CEO being a female rather than a male is 1.19 and 1.06 times higher if the board of directors and female directors' percentage, respectively, increase. The firm`s size has no significant impact on the CEO gender. All industry variables odds ratios are statistically insignificant. All time variables are significant and again prove that after quota policy implementation the odds of the CEO being a female increased even more than before.

6.3. Ownership Types and CEO Gender

For this group of variables, the models include 11,170 observations having 1,307 groups of unique observations.

We ran the conditional logistic regression with fixed effects using firm aggregate fractions owned by international, state, family, and institutional owners, the share owned by CEO, percentage of equity held by ultimate owners with the highest rank, largest family having CEO, aggregated fraction held by personal owners as independent variables (table 6.3.1).

The results of the regression show that international and state ownership types have no influence on the probability of the CEO being a female. The findings about state owned firms contradict previous research and our hypothesis. It might be due to state companies' scarcity in Norway. Out of 315,005 observations, only 1,293 are non-zero for state ownership and the maximum aggregate fraction of state ownership is 82.75%.This means that there are no fully state owned firms in our sample and there are not so many state owned companies in general. For international owners we proved the hypothesis. All other variables are statistically significant. Family and institutional ownership, which are completely in accordance with our hypotheses, percentage of equity held by ultimate owners with the highest rank, aggregated fraction held by personal owners increase the odds of the CEO being a female. However, the share owned by CEO and largest family having CEO

decrease this probability. The largest family having CEO has an opposite impact on the CEO gender than we hypothesized.

Table 6.3.1: Conditional Logistic Regression with Fixed Effects for Ownership Type Variables

The table displays the results of conditional logistic regressions with fixed effects with CEO gender as the dependent variable. The independent variables are firm aggregate fractions owned by institutional, family, state, and international owners, the share owned by CEO, percentage of equity held by ultimate owners with the highest rank, largest family having CEO, aggregated fraction held by personal owners. The standard errors are displayed in light grey and parenthesis under the coefficients. The significance levels are indicated as follows: * = 10%, ** = 5% and *** = 1%.

Independent variables	***Odds ratios***
State ownership	1.003
	(0.0225)
International ownership	1.008
	(0.008)
Institutional ownership	1.0258**
	(0.0127)
Family ownership (also partial)	1.0065**
	(0.0026)
The share owned by CEO	0.9705***
	(0.002)
Equity held by ultimate owners with the highest rank	1.007**
	(0.002)
Largest family has CEO	0.7175***
	(0.0595)
Aggregated fraction held by personal owners	1.0082***
	(0.003)
Number of observations	11170
Number of groups	1307
Observations per group (average)	8.5
Prob>chi^2	0.0000

When we controlled for time, the results of the regression showed that the international, state ownership, aggregated fraction held by personal owners, and percentage of equity held by ultimate owners with the highest rank have no influence on the probability of the CEO being a female (see appendices, table 6.3.2). Family and institutional ownerships increase the odds of the CEO being a female. However, the share owned by CEO and largest family having CEO have the opposite influence on the female CEO gender. All time variables have significant impact and the probability of CEO being female increases with years passing.

The results of the regression with industry control (see appendices, table 6.3.3) were the same as in the regression without any control variables. All industry variables have no significant impact on the odds of CEO being a female.

Consequently, the results of the regression with both time and industry controls (see appendices, table 6.3.4) were the same as in the regression with time control only. All industry variables are again non-significant.

6.4. All Firm`s Characteristics and CEO Gender

Finally, we ran the regressions using all the variables mentioned in the previous sections. Previous year`s leverage and company size, fraction of female directors on board, family ownership, share owned by CEO, and largest family having CEO have influence on the CEO gender (table 6.4.1).

Table 6.4.1: Conditional Logistic Regression with Fixed Effects for All Firm Characteristics

The table displays the results of conditional logistic regressions with fixed effects with CEO gender as the dependent variable. The independent variables are the first lags of ROA, leverage, and company size, firm aggregate fractions owned by institutional, family, state, and international owners, board of directors size, proportion of female directors, employees number, the share owned by CEO, percentage of equity held by ultimate owners with the highest rank, largest family having CEO, aggregated fraction held by personal owners. The standard errors are displayed in light grey and parenthesis under the coefficients. The significance levels are indicated as follows: * = 10%, ** = 5% and *** = 1%.

Independent variables	***Odds ratios***
Lagged leverage	0.9815**
	(0.0079)
Lagged ROA	0.9097
	(0.3118)
Lagged company size	1.2551**
	(0.1185)
Board of directors	1.0704
	(0.0639)
Percentage of female directors	1.0584***
	(0.0026)
Employees number	1.0113
	(0.0096)
State ownership	0.9628
	(0.0267)
International ownership	0.9998
	(0.0117)
Institutional ownership	1.0259
	(0.017)
Family ownership (also partial)	1.013***
	(0.004)
The share owned by CEO	0.9763***
	(0.0027)
Equity held by ultimate owners with the highest rank	0.9989
	(0.0041)
Largest family has CEO	0.7005***
	(0.0791)
Aggregated fraction held by personal owners	0.9976
	(0.0048)
Number of observations	6851
Number of groups	918
Observations per group (average)	7.5
Prob>chi^2	0.0000

The results support our hypotheses for financial, structural, family and international ownership, and firm size variables. As for largest family has CEO we got an opposite result. It decreases the odds of a female CEO and thus contradicts our hypothesis. Besides, state and institutional ownership variables are insignificant, which is not proving the previous academic research findings. Moreover, the number of employees variable does not have significant impact on the CEO gender.

That might be because Norwegian firms in our sample are not very large. The maximum number of employees is 728; therefore, it is more important what fraction of female directors there are in a firm. Besides, this means that it is good that we took also an alternative variable – natural logarithm of revenue since in this regression they show different results.

When we controlled for time in the regression, we got even less statistically significant variables (see appendices, table 6.4.2). However, again in the later years of the sample the effect on the female CEO gender is higher, especially after quota implementation.

Controlling for industry in the regression showed that no industry has an impact on CEO gender (see appendices, table 6.4.3). The variables prove and contradict our hypotheses in the same way as in the regression without controls.

Controlling for both time and industry showed us again that no industry has an impact on CEO gender but the time effects are still strong (see appendices, table 6.4.4). The financial variables, firm aggregate fractions owned by institutional, state, international owners, board of directors` size, number of employees, percentage of equity held by ultimate owners with the highest rank, and aggregated fraction held by personal owners are now insignificant. The proportion of female directors and family ownership type have positive impact on the odds of the CEO being a female and prove our hypotheses.

6.5. Difference-in-Difference Analysis: Quota Policy in Norway

We conducted the difference-in-difference analysis (table 6.5.1) to see if the quota policy had an effect on the CEO gender change to female, i. e. if the quota treatment was effective in the Norwegian firms.

We took different ownership types as treatment groups. The number of observations was 315,003.

In the regression for family owned firms, we observed that the difference-in-difference estimate is negative of -0.0029 and significant at 1% level. This demonstrates that quota treatment in family firms affects CEO gender change to female negatively meaning that in this type of companies a female is less likely to become a CEO in the quota period. This can be explained by the nature of these companies. We already proved empirically that family owned companies tend to have female CEOs with higher probability than male. Therefore, they do not have

many male to female changes. These firms are then not the main group for quota treatment.

Table 6.5.1: Difference-in-difference Analysis

The table displays the results from the difference-in-difference analysis we specified in section 4.5, with CEO gender change as the dependent variable. The gender change male to female means this variable equal to one. The second column contains the dummy variables included to calculate the difference between the firms with different ownership types. In every regression, the firms with specific ownership type are the treatment group and all other firms are the control group. The dummy variable is one if the firm is in the treatment group and zero for the firms in the control group. In every first row, the dummy variable for quota period is one if the firm appears in the treatment period 2006-2014 and zero if in the pre-treatment period 2001-2006. The third row displays the product of the variables in rows one and two. This dummy variable is the difference-in-difference estimator. The standard errors are displayed in light grey and parenthesis under the coefficients. The significance levels are indicated as follows: * = 10%, ** = 5% and *** = 1%.

Ownership type	*Independent variables*	*Coefficients*
Family owned firms	Quota period dummy	0.0048***
		(0.0005)
	Treatment group dummy	-0.0013***
		(0.0005)
	Difference-in-difference estimator	-0.0029***
		(0.0007)
	R-squared	0.0005
Internationally owned firms	Quota period dummy	0.003***
		(0.0003)
	Treatment group dummy	-0.0006
		(0.0019)
	Difference-in-difference estimator	0.0077**
		(0.0034)
	R-squared	0.0003
State owned firms	Quota period dummy	0.0031***
		(0.0003)
	Treatment group dummy	0.0056
		(0.0052)
	Difference-in-difference estimator	-0.0015
		(0.0072)
	R-squared	0.0002
Institutionally owned firms	Quota period dummy	0.0031***
		(0.0003)
	Treatment group dummy	-0.0043***
		(0.0002)
	Difference-in-difference estimator	0.0113**
		(0.0051)
	R-squared	0.0003

The quota treatment had a positive effect on the firms with international owners. We found out that the firms with this type of ownership have no effect on the CEO gender. However, this new finding means that there are still slight changes since in the quota period there is a higher possibility that the CEO gender will change male to female in these firms.

The quota policy did not affect the state owned firms according to our analysis. Usually there should be an opposite relationship. Still, the low number of state companies in Norway may explain our results.

Institutionally owned firms are positively treated by the quota policy. There were more male-to-female CEO changes in these companies in the quota period. This is in accordance with the hypotheses on this ownership type.

Generally, according to the statistics (table 6.5.2) the quota policy was not fully successfully implemented since there are still many observations in the 2006-2014 period where the desired amount of the female board directors is larger than the real. There are 1,668 companies` observations where the 40% female directors proportion is reached. However, the amount of observations where the quota requirement is not fulfilled is 3.85 times larger than the number of observations where there are more than 40% of females on board of directors.

Table 6.5.2: Comparison of the Real and Desired Fraction of Female Directors
The table displays the comparison between the desired number of female directors (quota) and the real fraction of female directors. The observations are taken after 2006.

	Observations	Difference		
		minimum	average	maximum
Quota < fraction of female directors	64542	-60	-32.39	-2.86
Quota = fraction of female directors	1668	0.2	35.85	40
Quota > fraction of female directors	248793	-3.8	21.68	40
Total	315003			

Our difference-in-difference analysis regressions have very low R-Squared, but we consider it acceptable as it gives us valuable indications on the effect of the quota treatment.

Multicollinearity Issues

Multicollinearity happens when two or more independent variables are highly correlated with each other. It increases the standard errors of regressors and might cause biases in their significance. In order to determine if this problem exists in our analysis, we performed a correlation analysis of our model regressors, which results are presented in table 6.5 (see appendices). According to the correlation matrix, there is no high correlation for financial and structure variables. However, we observe very high or high correlation between the ownership ones. The highest correlation is between “Percentage of equity held by first rank owner” and “Share owned by CEO” variables. It might happen because there are many CEOs owning shares as the owner with the first rank. Furthermore, another explanation for the

high correlations between ownership variables is the fact that the majority of Norwegian firms have more than one ownership type and they are not fully owned by one owner. Hence, we do not consider multicollinearity a big concern in our study.

Robustness Check

To perform the robustness check, we used control variables in all our logistic regressions. We ran the regressions with time, industry, and both these controls. Using industry control variables did not change the results significantly since these variables had no impact on the CEO gender – dependent variable. However, the time effects were quite important because they influenced the odds ratio of independent variables and showed that in the years after quota policy implementation the probability of CEO being a female was higher. We also used two different company size measures – revenue and number of employees. The number of employees has no impact on the CEO gender; however, the natural logarithm of revenue has positive impact on the odds of female being a CEO. Therefore, we can admit that it was important to use alternative variables.

Summary

In this section, we discussed the results of all regressions that we performed using CEO gender and CEO gender change as dependent variables.

The return on assets has no significant impact on the CEO gender. Thus, we contradict the first hypothesis from the "Theory" section. The previous research showed that if the CEO is female, the firm`s performance is better. We can now state that there is no reverse relationship. The firm`s performance does not influence the probability of the CEO being a female.

Furthermore, we proved the second hypothesis because the logistic regressions showed that the more a firm uses leverage the less probable is a female CEO. This might be explained by higher risk aversion of female CEOs according to academic literature. In addition, the number of female directors on board is an important factor that increases the odds of a female being CEO.

The quota policy influenced the CEO gender change from male to female. It did not happen for all the firms and there is still potential for improvement, but in general, the policy worked quite well.

We also realized that the higher the company size is in terms of revenue, the greater the probability of the CEO being a female. We got this result using the natural logarithm of revenue as firm`s size measure. However, another firm size variable that we used – the number of employees – has no effects on the CEO gender. That might be because Norwegian firms in our sample are not very large. The maximum number of employees is 728; therefore, it is more important what fraction of female directors there is in a firm.

Therefore, the hypotheses 3, 5 and 6 are proved. Moreover, our results are consistent with the previous research and our hypotheses 4.2, 4.3 and 4.4 since it is more likely that the CEO will be a female in family firms and firms owned by institutional investors, and international ownership has no influence on the CEO gender.

However, our results contradict hypotheses 4.1 and 4.5. State ownership has negative effect on the odds of the CEO being a female, which in our case might be explained by a very small proportion of state owned firms in our dataset. Moreover, the results show that a CEO who is a family member is less likely to be a female, which is completely opposite to our hypothesis.

Female CEOs: Why so Few?

We can conclude that the female CEO scarcity can be explained by several factors. First, our sample shows that Norwegian companies usually use a lot of debt financing. This is not associated with a female CEO appointment according to our analysis. Previous research proved that the female CEOs tend to be less risky and prefer using less debt financing. We also found out for the Norwegian companies that the more leverage the firm uses the less likely its CEO will be a female in the next time period. Furthermore, there are not many companies in Norway where female CEO appointment is more likely to happen according to the literature. This implies state owned companies, for instance. Our findings differ from other countries research since there are few state owned companies in Norway.

The quota policy was quite successful because it influenced male to female CEO changes. However, the desired number of female board directors is not reached yet. There is a positive tendency in Norway since the female CEOs number increases with years passing. Still, the female executives have to be supported. The research clearly shows that the larger number of female directors participates on the boards

the larger number of female CEOs can be appointed. This means that the quota policy should be continuously supported.

Conclusion

The main purpose of this paper was to explain the reasons for the low number of female chief executive officers by examining the factors that might influence the appointment of female CEOs in a sample of Norwegian companies. We also assessed whether the Norwegian quota policy has influenced the CEO gender changes from male to female.

First, we conducted conditional logistic regressions with fixed effects. This analysis tool is the most appropriate in our case since our dependent variable CEO gender is a binary and the fixed effects control for time-invariant unobserved firm characteristics. The results of Hausman test also give an econometric reason for the usage of fixed effects in all regressions. We controlled for industry and time effects in all logistic regressions. The industry effects appeared to be insignificant. However, the time effects supported the fact that quota policy helped to increase the number of female CEOs because the effects get stronger with passing time, especially after 2006. Then, we performed the difference-in-difference analysis for quota policy treatment of the Norwegian companies.

We found out that the fraction of female directors on board and firm`s size in terms of revenue positively influence the probability of the CEO being a female. Furthermore, it is more likely that the CEO will be a female in family firms and firms owned by institutional investors.

The quota policy was quite successful because it influenced male to female CEO changes. However, the desired number of female board directors is not reached yet.

On the other hand, the more leverage the firm uses the less probable is a female CEO. State ownership has also a negative effect on the odds of the CEO being a female, which we can explain by a small amount of state owned firms in the dataset. Moreover, the results show that a CEO who is a family member is less likely to be a female.

Finally, return on assets as company performance, international ownership, and employees number have no influence on the CEO gender.

We can conclude that the scarcity of female CEOs in Norway can be explained by the scarcity of companies that have the characteristics that lead to higher probability of CEO being a female. These factors according to our research are, for instance, larger fraction of female board directors and compliance with quota policy. Still,

we have to admit that there is a positive tendency of female CEOs number increase in Norway.

There are also some limitations regarding our study that we should consider. First, our sample is from 2000 to 2014. Therefore, it is affected by the financial crisis of 2008. This might affect our result about firm performance since the return on assets variable is definitely affected by the crisis. Second, our time horizon is limited and some companies have missing values for important variables in some years. Therefore, by gathering more data and extending the dataset to a longer period could further strengthen the results, especially about the quota policy effectiveness. Third, we are aware that factors that influence the CEO gender can be more complex than financial, structure, ownership type, time, and industry effects. Therefore, we have to admit we might not be able to include all the influential variables, hence, other factors should also be studied. Finally, for the industry codes we faced change in codes in 2009 which made our industry analysis biased.

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Appendices

Table 5.1: The Variables from the Centre for Corporate Governance Research Database at BI Norwegian Business School

The table includes 20 variables that we initially use for the analysis

Variable	Definition
item_2	CEO gender
item_9	Revenue
item_63	Total fixed assets
item_78	Total current assets
item_87	Total equity
item_d	Total debt
item_35	Income for extraordinary items
item_62	Board size
item_605	Number of female directors
item_fdp	Female directors proportion
item_11102	Industry code
item_15006	Enterprise type
item_50109	Number of employees
item_13601	Share owned by CEO
item_14011	Equity held by ultimate owners with rank 1
item_14018	Aggregated fraction held by industry institutional owners
item_14019	Aggregated fraction held by personal owners
item_14021	Aggregated fraction held by female owners
item_14022	Aggregated fraction held by state owners
item_14023	Aggregated fraction held by international owners
item_15302	Largest family sum ultimate ownership
item_15304	Largest family has CEO

Table 5.4: Female and Male CEOs Fraction

This table displays the total number of firms for each year and divides it to firms with female CEO and firms with male CEO. Column 1 presents the year, columns 2-4 presents the number of female CEOs, male CEOs, and whole firms for a year, respectively. Since the data set is unbalanced, we take the fraction of female and male CEOs for each year in respect to the number of firms for that year. Columns 5 and 6 display these fractions in percent.

time	Female	Male	Total	%Female	%Male	%Total
2000	2021	15375	17396	11.62%	88.38%	100.00%
2001	2091	14697	16788	12.46%	87.54%	100.00%
2002	2287	15664	17951	12.74%	87.26%	100.00%
2003	2952	18845	21797	13.54%	86.46%	100.00%
2004	3044	18812	21856	13.93%	86.07%	100.00%
2005	3072	16489	19561	15.70%	84.30%	100.00%
2006	3209	16460	19669	16.32%	83.68%	100.00%
2007	3847	19293	23140	16.62%	83.38%	100.00%
2008	3886	19510	23396	16.61%	83.39%	100.00%
2009	4148	19816	23964	17.31%	82.69%	100.00%
2010	4258	19806	24064	17.69%	82.31%	100.00%
2011	4293	19747	24040	17.86%	82.14%	100.00%
2012	3829	18334	22163	17.28%	82.72%	100.00%
2013	3575	16948	20523	17.42%	82.58%	100.00%
2014	3279	15416	18695	17.54%	82.46%	100.00%

Table 5.5: CEO Gender Change.

This table presents the number of changes in CEO gender for each year of the panel data set. The first column shows the year, the 2nd to 4th present the number of no change, change from male to female, and change from female to male for each year. Column 5 shows the total number of firms which we calculated the fractions in 6th to 9th column based on it. The fractions in percent are measured and used for comparison because the data set is unbalanced.

time	No change	Male to Female	Female to Male	Total	%No Change	%Male to Female	%Female to Male	%Total
2000	17396	0	0	17396	100.00%	0.00%	0.00%	100.00%
2001	16752	19	17	16788	99.79%	0.11%	0.10%	100.00%
2002	17875	44	32	17951	99.58%	0.25%	0.18%	100.00%
2003	21696	72	29	21797	99.54%	0.33%	0.13%	100.00%
2004	21786	40	30	21856	99.68%	0.18%	0.14%	100.00%
2005	19484	54	23	19561	99.61%	0.28%	0.12%	100.00%
2006	19582	56	31	19669	99.56%	0.28%	0.16%	100.00%
2007	23011	90	39	23140	99.44%	0.39%	0.17%	100.00%
2008	23288	64	44	23396	99.54%	0.27%	0.19%	100.00%
2009	23830	86	48	23964	99.44%	0.36%	0.20%	100.00%
2010	23928	80	56	24064	99.43%	0.33%	0.23%	100.00%
2011	23927	76	37	24040	99.53%	0.32%	0.15%	100.00%
2012	22026	86	51	22163	99.38%	0.39%	0.23%	100.00%
2013	20414	58	51	20523	99.47%	0.28%	0.25%	100.00%
2014	18576	73	46	18695	99.36%	0.39%	0.25%	100.00%

Table 5.6: Industry Codes and CEO Gender

This table displays the industry classifications and the fractions of firms with female CEO and firms with male CEO for each industry. These fractions are calculated as the number of firm-year observations with female/male CEO in an industry divided by the total number of observations for that industry. In the table, the 1st and 7th columns present the first two digits of NAIC industry codes. The 2nd and 8th show the total number of firm-year observation for the industry. Column 3,4 and 9,10 present the number of female CEOs and male CEOs in the industry. The rest of columns show the explained fraction in percent.

IC	Total firms	Female CEO	Male CEO	Female CEO %	Male CEO %	IC	Total firms	Female CEO	Male CEO	Female CEO %	Male CEO %
1	2161	254	1907	11.8%	88.2%	49	5712	126	5586	2.2%	97.8%
2	1077	9	1068	0.8%	99.2%	50	11295	556	10739	4.9%	95.1%
3	435	10	425	2.3%	97.7%	51	17656	1335	16321	7.6%	92.4%
5	731	9	722	1.2%	98.8%	52	31723	10159	21564	32.0%	68.0%
8	384	9	375	2.3%	97.7%	53	113	6	107	5.3%	94.7%
9	35	0	35	0.0%	100.0%	55	7437	2090	5347	28.1%	71.9%
10	1223	245	978	20.0%	80.0%	56	3995	1252	2743	31.3%	68.7%
11	108	0	108	0.0%	100.0%	58	823	90	733	10.9%	89.1%
13	281	46	235	16.4%	83.6%	59	386	63	323	16.3%	83.7%
14	679	120	559	17.7%	82.3%	60	7032	177	6855	2.5%	97.5%
15	2357	286	2071	12.1%	87.9%	61	775	32	743	4.1%	95.9%
16	1123	26	1097	2.3%	97.7%	62	2216	77	2139	3.5%	96.5%
17	652	181	471	27.8%	72.2%	63	1950	284	1666	14.6%	85.4%
18	1172	155	1017	13.2%	86.8%	64	388	32	356	8.2%	91.8%
19	49	21	28	42.9%	57.1%	65	61	3	58	4.9%	95.1%
20	2130	93	2037	4.4%	95.6%	66	263	13	250	4.9%	95.1%
21	108	8	100	7.4%	92.6%	67	433	19	414	4.4%	95.6%
22	3350	233	3117	7.0%	93.0%	68	2543	338	2205	13.3%	86.7%
23	584	58	526	9.9%	90.1%	69	5657	1778	3879	31.4%	68.6%
24	274	20	254	7.3%	92.7%	70	4425	611	3814	13.8%	86.2%
25	2785	144	2641	5.2%	94.8%	71	6167	520	5647	8.4%	91.6%
26	1112	101	1011	9.1%	90.9%	72	3498	146	3352	4.2%	95.8%
27	643	17	626	2.6%	97.4%	73	1020	242	778	23.7%	76.3%
28	4218	147	4071	3.5%	96.5%	74	25914	4369	21545	16.9%	83.1%
29	2481	54	2427	2.2%	97.8%	75	496	252	244	50.8%	49.2%
30	284	11	273	3.9%	96.1%	77	647	62	585	9.6%	90.4%
31	1217	48	1169	3.9%	96.1%	78	510	131	379	25.7%	74.3%
32	809	184	625	22.7%	77.3%	79	414	152	262	36.7%	63.3%
33	2065	172	1893	8.3%	91.7%	80	1699	205	1494	12.1%	87.9%
34	250	1	249	0.4%	99.6%	81	1958	299	1659	15.3%	84.7%
35	1287	24	1263	1.9%	98.1%	82	798	154	644	19.3%	80.7%
36	1407	154	1253	10.9%	89.1%	85	8513	2159	6354	25.4%	74.6%
37	225	2	223	0.9%	99.1%	86	4892	1196	3696	24.4%	75.6%
38	224	12	212	5.4%	94.6%	87	122	35	87	28.7%	71.3%
39	10	3	7	30.0%	70.0%	88	1247	1013	234	81.2%	18.8%
40	40	0	40	0.0%	100.0%	90	900	156	744	17.3%	82.7%
41	8702	101	8601	1.2%	98.8%	91	28	1	27	3.6%	96.4%
42	966	16	950	1.7%	98.3%	92	1465	290	1175	19.8%	80.2%
43	19807	380	19427	1.9%	98.1%	93	5470	3409	2061	62.3%	37.7%
45	40515	643	39872	1.6%	98.4%	94	13	6	7	46.2%	53.8%
46	10382	959	9423	9.2%	90.8%	95	316	7	309	2.2%	97.8%
47	21887	8079	13808	36.9%	63.1%	96	3804	2914	890	76.6%	23.4%

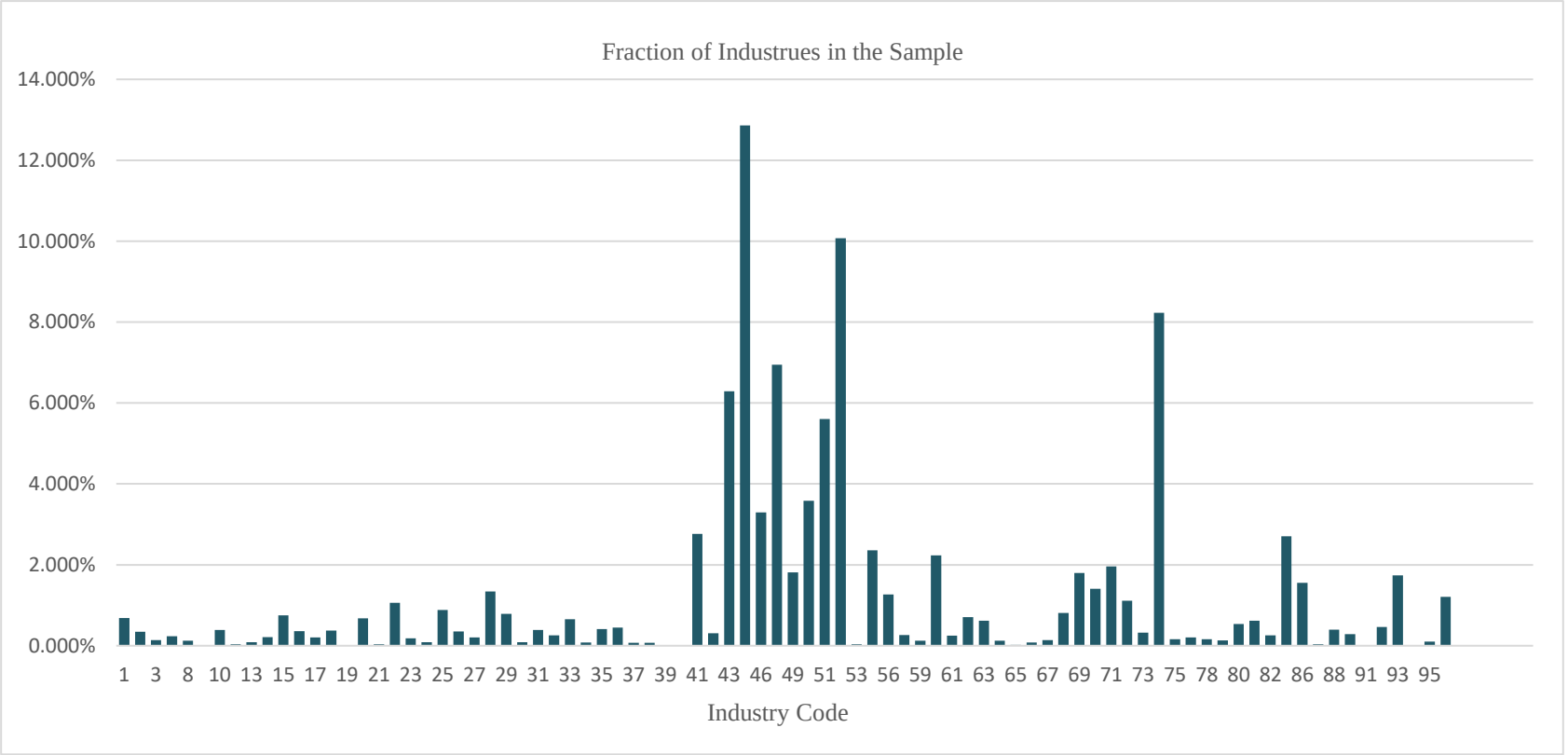
Table 5.3: Descriptive Statistics

The table displays descriptive statistics for the used variables in the base model after applying mentioned filters. The variables are describing 40,80 firms over 15 years, 2000-2104 and are divided in two main groups: firms with female CEO and firms with male CEO. The last column of the table presents the t-statistics of the mean difference test with %95 confidence interval for these two groups, the difference is significant if the t-statistics is in [-1.96, 1.96]. Board size presents the number of board members in a firm. The % fraction of female directors is in percent and is defined as100* number of female directors/board size. Return on assets and leverage ratio are defined as income before extraordinary items/total assets and total debt/total equity, respectively. Log Revenue is the natural logarithm of revenue. The aggregated fractions of ownership types take values in [0,100] interval and share owned by CEO is presented in percent. Finally, largest family has CEO is a binary variable and takes 1 if the largest family has CEO and 0 otherwise.

	Whole sample		**Firms with Male CEO**		**Firms with Female CEO**		**Mean Difference**
Variable	**Mean**	**Median**	**Mean**	**Median**	**Mean**	**Median**	**t-statistics (%95)**
Number of Observations	315,003		265,212		49,791		
Board Size	2.132021	2	2.140503	2	2.086843	2	9.2920
Number of Employees	7.969003	5	8.183679	5	6.825531	5	30.8813
% of Fraction of Female Directors (2000-2014)	18.32462	0	8.98639	0	68.06475	66.66667	-3.8e+02
% of Fraction of Female Directors (2004-2014)	19.07178	0	9.115498	0	68.46693	66.66667	-4.8e+02
Total Equity	2,044,743	680,000	2,210,360	753,500	1,162,583	401,000	25.2602
Total Debt	3,853,578	1,754,000	4,179,218	1,935,000	2,119,053	1,035,000	49.1657
Total Assets	5,898,321	2,684,000	6,389,578	2,960,000	3,281,636	1,572,000	40
Return on Assets	0.093925	0.0822462	0.094949	0.0831656	0.0884709	0.077268	10.4746
Leverage Ratio	4.318202	2.570506	4.321684	2.578831	4.299655	2.525	0.7778
Log Revenue	15.5273	15.49876	15.60216	15.58537	15.12855	15.10033	89.4197
Aggregate Fraction Held by Institutional Owners	0.0760019	0	0.0750015	0	0.0813307	0	-0.6584
Aggregate Fraction Held by State Owners	0.0659206	0	0.0684816	0	0.0522794	0	2.3718
Aggregate Fraction Held by International Owners	0.4335113	0	0.4415456	0	0.3907162	0	2.3967
Aggregate Fraction Held by Personal Owners	95.90119	100	95.75458	100	96.68215	100	-16.5394
Share Owned by CEO	63.65255	54.91	63.93578	58.285	62.14393	50	12.3031
% of Equity held by Ultimate owner with rank 1	67.25489	60	67.45899	60	66.16772	52	9.9527
Largest Family Sum Ultimate Ownership	79.00598	100	78.73652	100	80.4413	100	-13.3390
Largest Family has CEO	0.8432713	1	0.8451691	1	.8331626	1	6.6243

Graph 5.3: Industry Fractions

The graph displays the fraction of each industry in the sample. The fraction is calculated as the number of observations for an industry divided by the number of sample observations, 315,003. The x-axis shows the industry codes as the first two digits of NAIC codes and the y-axis presents the fractions in percent.



Graph 5.4: Industry Fractions by CEO Gender

This graph displays the existing industry classifications in our data sample with the proportion of firms with female CEO and firms with male CEO in each industry. NAIC industry classification specifies a 5 digits industry code to each firm. In our analysis, we take the first two digits for simplicity. As we observe in the graph for each industry the blue part represents %fraction of firms with female CEO and the pink part shows the %fraction for firms with male CEO.

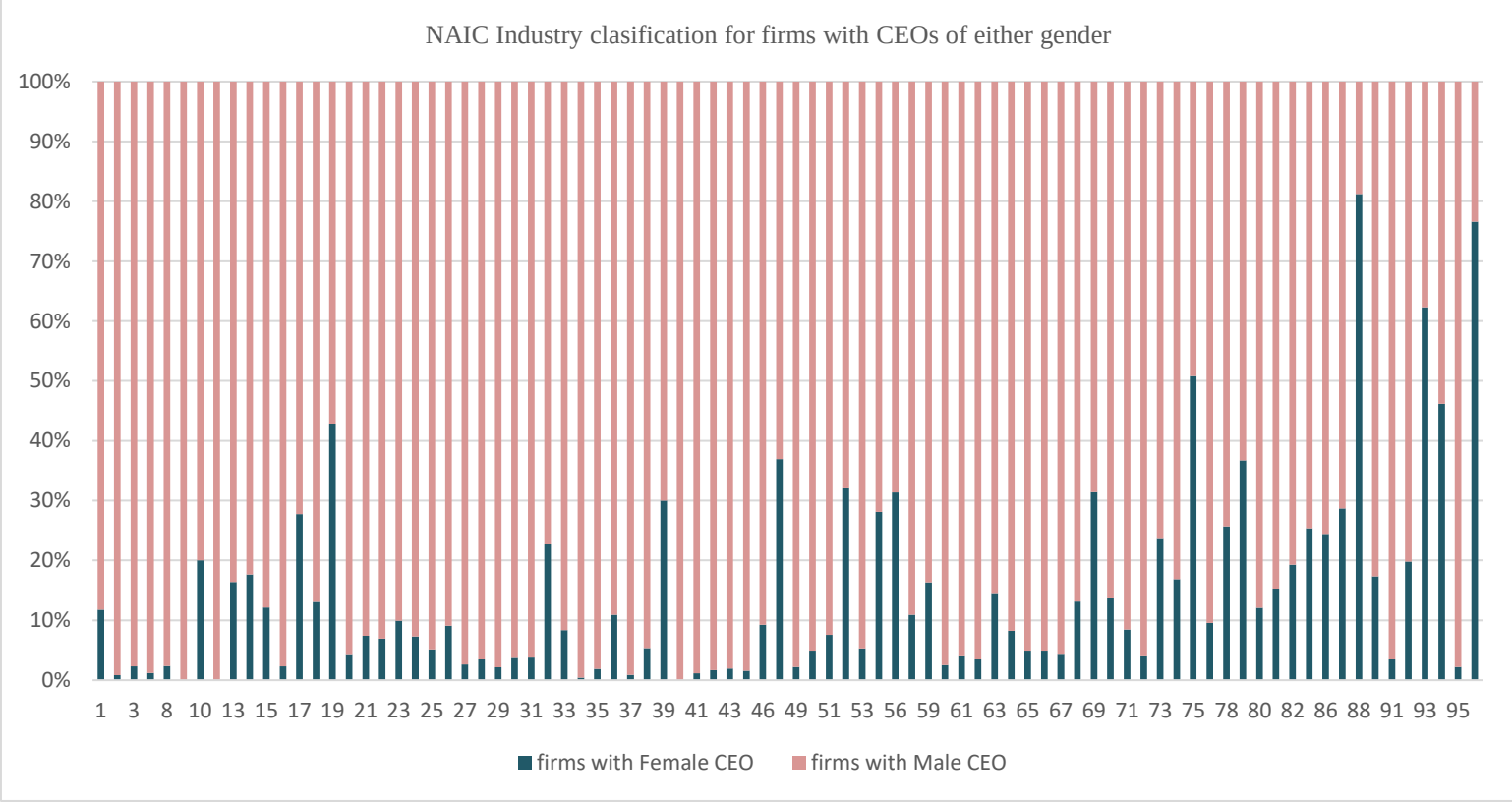


Table 6.1: Hausman Test Results for Lagged Financial Variables

Contains the Stata output for the Hausman test for lagged financial variables. The result of the test is rejection of the null hypothesis. Therefore, we have to use fixed effects in the logistic regression.

	Coefficients			
Variables	(b) fe	(B) re	(b-B) Difference	sqrt(diag(V_b-V_B)) S.E.
roa				
LI.	-.5067411	-.0277956	-.4789454	.2087722
lev				
LI.	-.0353525	-.0214198	-.0139327	.0054522
logrev				
LI.	.3452068	-.6442798	.9894866	.0707107

b = consistent under Ho and Ha; obtained from xtlogit

B = inconsistent under Ha, efficient under Ho; obtained from xtlogit

Test: Ho: difference in coefficients not systematic

chi2(3) = (b-B)`[(V_b-V_B)^(-1)](b-B) = 214.00

Prob>chi2 = 0.0000

Table 6.2: Hausman Test Results for Structural Variables

Contains the Stata output for the Hausman test for structural variables. The result of the test is rejection of the null hypothesis. Therefore, we have to use fixed effects in the logistic regression.

	Coefficients			
Variables	(b) fe	(B) re	(b-B) Difference	sqrt(diag (V_b-V_B)) S.E.
bs	.1967137	-.303813	.5005267	.0228779
en	.0574491	.1947165	-.1372674	.001482
fdp_percen~e	-.0064085	.0015035	-.007912	.0049447
logrev	.385737	-.3300945	.7158315	.055217

b - consistent under Ho and Ha; obtained from xtlogit

B - inconsistent under Ha, efficient under Ho; obtained from xtlogit

Test: Ho: difference in coefficients not systematic

chi2(3) = (b-B)'[(V_b-V_B)^(-1)](b-B) = 9889.86

Prob>chi2 = 0.0000

Table 6.3: Hausman Test Results for Ownership Type Variables

Contains the Stata output for the Hausman test for ownership type variables. The result of the test is rejection of the null hypothesis. Therefore, we have to use fixed effects in the logistic regression.

	Coefficients			
	(b)	(B)	(b-B)	sqrt(diag(V_b-V_B))
Variables	fe	re	Difference	S.E.
sh_ceo	- . 0299377	-.03744	.0074823	.0009267
equityhl	.0070113	.0055561	.0014552	.0016526
lnst_o	.0234982	.0263277	-.0010295	.007301
s_o	.0029654	.0009521	.0020133	.0144774
intn_o	.0079458	.0114986	-.0033528	.0033203
lst_f_o	.0065073	.018122	-.0116147	.0018963
lst_f_ceo	-.3320423	-.3461552	.0141129	.0375512
persn_o	.0081867	.0076998	.0004869	.0017427

b = consistent under Ho and Ha; obtained from xtlogit

B = inconsistent under Ha, efficient under Ho; obtained fro» xtlogit

Test: Ho: difference in coefficients not systematic

Chi2(8) = (b-B)'[(V_b-V_B)^(-l)](b-B) = 124.76

Prob>chi2 = 0.0000

Table 6.4: Hausman Test Results for all Variables

Contains the Stata output for the Hausman test for all variables. The result of the test is rejection of the null hypothesis. Therefore, we have to use fixed effects in the logistic regression.

	Coefficients			
Variables	(b) fe	(B) re	(b-B) Difference	sqrt(diag(V_b-V_B)) S.E.
bs	.0680688	-.7209847	.7890535	.0347761
sh_ceo	-.0239542	-.0384976	.0145434	.0012652
equityh1	-.0011433	.0151704	-.0163138	.0027685
inst_o	.0255508	.0252027	.0003481	.0119116
s_o	-.0379278	-.0277544	-.0101734	.0021187
intn_o	-.0002303	.0048832	-.0051135	.0095335
lst_f_o	.0128958	-.0091369	.0220327	.0031942
lst_f_ceo	-.3559964	-.5171025	.1611061	.0699473
persn_o	-.0024483	.012302	-.0147503	.0031643
en	.0112283	.0049132	.0063152	.0089715
fdp_percen~e	.0567553	.2072206	-.1504653	.0020272
lev				
LI.	-.0186961	-.0015398	-.0171562	.0064559
roa				
LI.	-.0945385	.2500629	-.3446014	.2685336
logrev				
LI.	.2272443	-.5530898	.7803341	.086398

b = consistent under Ho and Ha; obtained from xtlogit

B = inconsistent under Ha, efficient under Ho; obtained from xtlogit

Test: Ho: difference in coefficients not systematic

chi2(14) = (b-B)'[(V_b-V_B)^(-1)](b-B) = 2153.59

Prob>chi2 = 0.0000

Table 6.1.2: Conditional Logistic Regression with Fixed Effects and Time Control for Lagged Financial Variables

The table displays the results of conditional logistic regressions with fixed effects with CEO gender as the dependent variable. The independent variables are the first lags of ROA, leverage, and company size as control. The company size is calculated as natural logarithm of revenue. The control variable is time (year). The standard errors are displayed in light grey and parenthesis under the coefficients. The significance levels are indicated as follows: * = 10%, ** = 5% and *** = 1%.

Independent and control variables	*Odds ratios*
Lagged leverage	0.9884*
	(0.0072)
Lagged ROA	1.0648
	(0.3231)
Lagged company size	0.8366**
	(0.0694)
Years:	
2002	1.2734
	(0.1954)
2003	1.7399***
	(0.2756)
2004	1.5583***
	(0.2378)
2005	1.887***
	(0.2992)
2006	2.1129***
	(0.3347)
2007	3.0437***
	(0.49)
2008	3.2479***
	(0.5145)
2009	3.3455***
	(0.532)
2010	4.386***
	(0.6927)
2011	5.0906***
	(0.8107)
2012	5.7309***
	(0.9325)
2013	5.7642***
	(0.9386)
2014	7.8028***
	(1.3157)
Number of observations	6851
Number of groups	918
Observations per group (average)	7.5
Prob>chi^2	0.0000

Table 6.1.4: Conditional Logistic Regression with Fixed Effects and Time and Industry Controls for Financial Variables

The table displays the results of conditional logistic regressions with fixed effects with CEO gender as the dependent variable. The independent variables are the first lags of ROA, leverage, and company size as control. The company size is calculated as natural logarithm of revenue. The control variables are time (year) and industry. The standard errors are displayed in light grey and parenthesis under the coefficients. The significance levels are indicated as follows: * = 10%, ** = 5% and *** = 1%. **All industries odds ratios are statistically insignificant at 10% level, therefore, not presented in the table.**

Independent and control variables	***Odds ratios***
Lagged leverage	0.9876*
	(0.0072)
Lagged ROA	1.095
	(0.3347)
Lagged company size	0.8453**
	(0.0711)
Years:	
2002	1.2864
	(0.1979)
2003	1.7576***
	(0.2793)
2004	1.5579***
	(0.2383)
2005	1.8956***
	(0.3012)
2006	2.1426***
	(0.3402)
2007	3.0404***
	(0.4908)
2008	3.2809***
	(0.5217)
2009	3.9293***
	(0.6775)
2010	5.2098***
	(0.8918)
2011	6.06***
	(1.0435)
2012	6.791***
	(1.1897)
2013	6.8506***
	(1.2039)
2014	9.4122***
	(1.7112)
Number of observations	6851
Number of groups	918
Observations per group (average)	7.5
Prob>chi^2	0.0000

Table 6.2.2: Conditional Logistic Regression with Fixed Effects and Time Control for Structural Variables

The table displays the results of conditional logistic regressions with fixed effects with CEO gender as the dependent variable. The independent variables are board of directors size, proportion of female directors, employees number, and company size (natural logarithm of revenue). The control variable is time (year). The standard errors are displayed in light grey and parenthesis under the coefficients. The significance levels are indicated as follows: * = 10%, ** = 5% and *** = 1%.

Independent variables	***Odds ratios***
Board of directors	1.1749***
	(0.0532)
Percentage of female directors	1.0571***
	(0.002)
Employees number	0.9912
	(0.0061)
Company size	1.0756
	(0.0692)
Years:	
2001	1.29287*
	(0.1894)
2002	1.6001***
	(0.2357)
2003	2.096***
	(0.2948)
2004	1.8587***
	(0.2668)
2005	2.2335***
	(0.3227)
2006	2.7834***
	(0.41)
2007	3.2826***
	(0.4737)
2008	3.3385***
	(0.4853)
2009	3.7289***
	(0.5355)
2010	3.9968***
	(0.5774)
2011	4.7105***
	(0.6882)
2012	5.1237***
	(0.7608)
2013	5.2531***
	(0.7922)
2014	6.42***
	(0.9966)
Number of observations	11170
Number of groups	1307
Observations per group (average)	8.5
Prob>chi^2	0.0000

Table 6.2.4: Conditional Logistic Regression with Fixed Effects, Industry and Time Controls for Structural Variables

The table displays the results of conditional logistic regressions with fixed effects with CEO gender as the dependent variable. The independent variables are board of directors size, proportion of female directors, employees number, and company size (natural logarithm of revenue). The control variables are time (year) and industry. The standard errors are displayed in light grey and parenthesis under the coefficients. The significance levels are indicated as follows: * = 10%, ** = 5% and *** = 1%. **All industries odds ratios are statistically insignificant at 10% level, therefore, not presented in the table**.

Independent and control variables	***Odds ratios***
Board of directors	1.1727***
	(0.0513)
Percentage of female directors	1.0571***
	(0.002)
Employees number	0.9913
	(0.006)
Company size	1.0867
	(0.0703)
Years:	
2001	1.2978*
	(0.1903)
2002	1.6202***
	(0.2372)
2003	2.1132***
	(0.2976)
2004	1.8726***
	(0.2688)
2005	2.2435***
	(0.3241)
2006	2.7883***
	(0.4067)
2007	3.2836***
	(0.4741)
2008	3.3511***
	(0.4875)
2009	3.8748***
	(0.5607)
2010	4.1726***
	(0.6084)
2011	4.9048***
	(0.7224)
2012	5.326***
	(0.7965)
2013	5.4584***
	(0.829)
2014	6.668***
	(1.0423)
Number of observations	11170
Number of groups	1307
Observations per group (average)	8.5
Prob>chi^2	0.0000

Table 6.3.2: Conditional Logistic Regression with Fixed effects and Time Controls for Ownership Type Variables

The table displays the results of conditional logistic regressions with fixed effects with CEO gender as the dependent variable. The independent variables are firm aggregate fractions owned by institutional, family, state, and international owners, the share owned by CEO, percentage of equity held by ultimate owners with the highest rank, largest family having CEO, aggregated fraction held by personal owners. The control variable is time (year). The standard errors are displayed in light grey and parenthesis under the coefficients. The significance levels are indicated as follows: * = 10%, ** = 5% and *** = 1%.

Independent and control variables	***Odds ratios***
State ownership	0.9956
	(0. 0228)
International ownership	0.9898
	(0.0081)
Institutional ownership	1.0231*
	(0.0132)
Family ownership (also partial)	1.0066**
	(0.0027)
The share owned by CEO	0.9764***
	(0.0021)
Equity held by ultimate owners with the highest rank	0.9991
	(0.0029)
Largest family has CEO	0.7542***
	(0.0640)
Aggregated fraction held by personal owners	1.0038
	(0.0031)
Years:	
2001	1.361**
	(0.1821)
2002	1.484***
	(0.2001)
2003	1.8817***
	(0.2446)
2004	1.9403***
	(0.2527)
2005	2.1851***
	(0.2885)
2006	2.7437***
	(0.365)
2007	3.5191***
	(0.4565)
2008	3.788***
	(0.4953)
2009	4.1759***
	(0.5413)
2010	4.6832***
	(0.6082)
2011	5.7257***
	(0.7506)
2012	6.0136***
	(0.7979)
2013	6.1382***
	(0.8265)
2014	7.7271***
	(1.0627)
Number of observations	11170
Number of groups	1307
Observations per group (average)	8.5
Prob>chi^2	0.0000

Table 6.3.3: Conditional Logistic Regression with Fixed Effects and Industry Control for Ownership Type Variables

The table displays the results of conditional logistic regressions with fixed effects with CEO gender as the dependent variable. The independent variables are firm aggregate fractions owned by institutional, family, state, and international owners, the share owned by CEO, percentage of equity held by ultimate owners with the highest rank, largest family having CEO, aggregated fraction held by personal owners. The control variable is industry. The standard errors are displayed in light grey and parenthesis under the coefficients. The significance levels are indicated as follows: * = 10%, ** = 5% and *** = 1%. **All industries odds ratios are statistically insignificant at 10% level, therefore, not presented in the table**.

Independent and control variables	***Odds ratios***
State ownership	1.0056
	(0. 0229)
International ownership	1.0064
	(0.0081)
Institutional ownership	1.0265**
	(0.0129)
Family ownership (also partial)	1.0071***
	(0.0026)
The share owned by CEO	0.9715***
	(0.002)
Equity held by ultimate owners with the highest rank	1.0054*
	(0.0029)
Largest family has CEO	0.7089***
	(0.0593)
Aggregated fraction held by personal owners	1.0069**
	(0.0031)
Number of observations	11170
Number of groups	1307
Observations per group (average)	8.5
Prob>chi^2	0.0000

Table 6.3.4: Conditional Logistic Regression with Fixed Effects with Time and Industry Controls for Ownership Type Variables

The table displays the results of conditional logistic regressions with fixed effects with CEO gender as the dependent variable. The independent variables are firm aggregate fractions owned by institutional, family, state, and international owners, the share owned by CEO, percentage of equity held by ultimate owners with the highest rank, largest family having CEO, aggregated fraction held by personal owners. The control variables are time (year) and industry. The standard errors are displayed in light grey and parenthesis under the coefficients. The significance levels are indicated as follows: * = 10%, ** = 5% and *** = 1%. **All industries odds ratios are statistically insignificant at 10% level, therefore, not presented in the table.**

Independent and control variables	***Odds ratios***
State ownership	1.0047
	(0. 0247)
International ownership	0.9918
	(0.0082)
Institutional ownership	1.0246*
	(0.0131)
Family ownership (also partial)	1.007***
	(0.0027)
The share owned by CEO	0.9761***
	(0.0021)
Equity held by ultimate owners with the highest rank	0.9994
	(0.003)
Largest family has CEO	0.7455***
	(0.0636)
Aggregated fraction held by personal owners	1.004
	(0.0032)
Years:	
2001	1.3562**
	(0.1815)
2002	1.4891***
	(0.201)
2003	1.8933***
	(0.2447)
2004	1.9414***
	(0.2532)
2005	2.1922***
	(0.2898)
2006	2.7392***
	(0.3648)
2007	3.5056***
	(0.4551)
2008	3.8028***
	(0.4985)
2009	4.6258***
	(0.6479)
2010	5.2513***
	(0.7357)
2011	6.4236***
	(0.9048)
2012	6.7116***
	(0.9547)
2013	6.8803***
	(0.9947)
2014	8.6489***
	(1.273)
Number of observations	11170
Number of groups	1307
Observations per group (average)	8.5
Prob>chi^2	0.0000

Table 6.4.2: Conditional Logistic Regression with Fixed Effects and Time Control for all Firm Characteristics

The table displays the results of conditional logistic regressions with fixed effects with CEO gender as the dependent variable. The independent variables are the first lags of ROA, leverage, and company size, firm aggregate fractions owned by institutional, family, state, and international owners, board of directors size, proportion of female directors, employees number, the share owned by CEO, percentage of equity held by ultimate owners with the highest rank, largest family having CEO, aggregated fraction held by personal owners. The control variable is time (year). The standard errors are displayed in light grey and parenthesis under the coefficients. The significance levels are indicated as follows: * = 10%, ** = 5% and *** = 1%.

Independent and control variables	***Odds ratios***
Lagged leverage	0.9964
	(0.0082)
Lagged ROA	1.3726
	(0.4822)
Lagged company size	0.8303*
	(0.0833)
Board of directors	1.0386
	(0.0636)
Percentage of female directors	1.0571***
	(0.0026)
Employees number	1.0101
	(0.0099)
State ownership	0.9603
	(0.026)
International ownership	0.9874
	(0.0119)
Institutional ownership	1.0279
	(0.0178)
Family ownership (also partial)	1.0112***
	(0.0041)
The share owned by CEO	0.9798***
	(0.0028)
Equity held by ultimate owners with the highest rank	0.9937
	(0.0042)
Largest family has CEO	0.7286***
	(0.0837)
Aggregated fraction held by personal owners	0.9967
	(0.0045)
Years:	
2002	1.3135
	(0.229)
2003	2.0396***
	(0.3658)
2004	1.4716**
	(0.2582)
2005	1.687***
	(0.3052)
2006	1.962***
	(0.3519)
2007	2.6202***
	(0.4807)
2008	2.5362***
	(0.4619)
2009	2.6808***
	(0.4877)
2010	3.209***
	(0.5831)
2011	3.7911***
	(0.6941)
2012	4.5631***
	(0.8516)
2013	4.3101***
	(0.8098)
2014	5.7815***
	(1.1336)
Number of observations	6851
Number of groups	918
Observations per group (average)	7.5
Prob>chi^2	0.0000

Table 6.4.3: Conditional Logistic Regression with Fixed Effects and Industry Control for all Firm Characteristics

The table displays the results of conditional logistic regressions with fixed effects with CEO gender as the dependent variable. The independent variables are the first lags of ROA, leverage, and company size, firm aggregate fractions owned by institutional, family, state, and international owners, board of directors size, proportion of female directors, employees number, the share owned by CEO, percentage of equity held by ultimate owners with the highest rank, largest family having CEO, aggregated fraction held by personal owners. The control variable is industry. The standard errors are displayed in light grey and parenthesis under the coefficients. The significance levels are indicated as follows: * = 10%, ** = 5% and *** = 1%. **All industries odds ratios are statistically insignificant at 10% level, therefore, not presented in the table.**

Independent and control variables	*Odds ratios*
Lagged leverage	0.9842*
	(0.008)
Lagged ROA	1.0544
	(0.3659)
Lagged company size	1.2026*
	(0.1181)
Board of directors	1.0591
	(0.064)
Percentage of female directors	1.058***
	(0.0026)
Employees number	1.0095
	(0.0096)
State ownership	0.9682
	(0.0267)
International ownership	0.9996
	(0.012)
Institutional ownership	1.0278
	(0.0172)
Family ownership (also partial)	1.0133***
	(0.0041)
The share owned by CEO	0.9765***
	(0.0027)
Equity held by ultimate owners with the highest rank	0.9984
	(0.0041)
Largest family has CEO	0.6865***
	(0.0781)
Aggregated fraction held by personal owners	0.9973
	(0.0045)
Number of observations	6851
Number of groups	918
Observations per group (average)	7.5
Prob>chi^2	0.0000

Table 6.4.4: Conditional Logistic Regression with Fixed Effects, Time and Industry Control for all Firm Characteristics

The table displays the results of conditional logistic regressions with fixed effects with CEO gender as the dependent variable. The independent variables are the first lags of ROA, leverage, and company size, firm aggregate fractions owned by institutional, family, state, and international owners, board of directors size, proportion of female directors, employees number, the share owned by CEO, percentage of equity held by ultimate owners with the highest rank, largest family having CEO, aggregated fraction held by personal owners. The control variables are time (year) and industry. The standard errors are displayed in light grey and parenthesis under the coefficients. The significance levels are indicated as follows: * = 10%, ** = 5% and *** = 1%. **All industries odds ratios are statistically insignificant at 10% level, therefore, not presented in the table.**

Independent and control variables	***Odds ratios***
Lagged leverage	0.9952
	(0.0082)
Lagged ROA	1.339
	(0.4757)
Lagged company size	0.8523
	(0.0873)
Board of directors	1.032
	(0.0638)
Percentage of female directors	1.0577***
	(0.0027)
Employees number	1.0092
	(0.01)
State ownership	0.9672
	(0.0274)
International ownership	0.9892
	(0.0119)
Institutional ownership	1.0277
	(0.0172)
Family ownership (also partial)	1.0115***
	(0.0041)
The share owned by CEO	0.9798***
	(0.0028)
Equity held by ultimate owners with the highest rank	0.994
	(0.0042)
Largest family has CEO	0.7118***
	(0.0824)
Aggregated fraction held by personal owners	0.9966
	(0.0046)
Years:	
2002	1.3339
	(0.2337)
2003	2.0653***
	(0.3722)
2004	1.4716**
	(0.2589)
2005	1.7049***
	(0.3092)
2006	1.9831***
	(0.3569)
2007	2.6234***
	(0.4823)
2008	2.5777***
	(0.4721)
2009	3.3508***
	(0.6592)
2010	4.0745***
	(0.8004)
2011	4.7989***
	(0.9443)
2012	5.7193***
	(1.1444)
2013	5.4358***
	(1.0959)
2014	7.3514***
	(1.5434)
Number of observations	6851
Number of groups	918
Observations per group (average)	7.5
Prob>chi^2	0.0000

Table 6.5: Correlation Matrix

The table displays the correlations between independent variables in our analysis. The first column represents variable number which is the same as the first row of the table. The main diameter shows the correlation of a variable with itself which is equal to 1 for all variables.

		1	2	3	4	5	6	7	8	9	10	11	12	13	14
1	Leverage Ratio	1.0000													
2	ROA	-0.1600	1.0000												
3	Log Revenue	0.0341	0.0813	1.0000											
4	Board Size	-0.0133	-0.0312	0.2323	1.0000										
5	Number of Employees	0.0376	-0.0104	0.4601	0.2220	1.0000									
6	Fraction of Female Directors	-0.0082	-0.0238	-0.1427	0.0517	-0.0332	1.0000								
7	Share owned by CEO	0.0106	0.0067	-0.1607	-0.3724	-0.1322	-0.0019	1.0000							
8	% Equity Held by #1 Owner	0.0086	0.0001	-0.1221	-0.4667	-0.1009	-0.0107	0.9172	1.0000						
9	A. F. Held by Institutional Owner	-0.0032	-0.0000	0.0190	0.0470	0.0218	-0.0052	-0.0528	-0.0301	1.0000					
10	A. F. Held by State Owners	-0.0121	-0.0094	0.0126	0.0578	0.0191	-0.0056	-0.0613	-0.0527	0.0328	1.0000				
11	A. F. Held by international Owner	-0.0001	0.0003	0.0599	0.0628	0.0219	-0.0069	-0.0981	-0.0407	0.0005	0.0035	1.0000			
12	A. F. Held by Personal Owner	0.0194	0.0119	-0.1021	-0.2011	-0.0986	0.0373	0.3299	0.2617	-0.1680	-0.1753	-0.3732	1.0000		
13	Largest Family sum ult Ownership	0.0014	-0.0275	-0.1350	-0.4054	-0.1024	0.0705	0.6684	0.6899	-0.0756	-0.0843	-0.1479	0.4484	1.0000	
14	Largest Family has CEO	-0.0069	-0.0236	-0.0939	-0.3119	-0.0698	0.0345	0.4560	0.4103	-0.0105	-0.0193	0.0005	0.0580	0.5612	1.0000

Preliminary Master Thesis

Female CEOs: Why so few?

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Abstract

There has been much debate on CEO gender and its effects on firm performance and characteristics. In this paper, we try to explain the reasons for female chief executive officers (CEOs) fewness, while examining the attributes that might influence the appointment of female CEOs in a sample of Norwegian companies. We extend the literature since the previous research is focused mostly on the factors that influence boardroom diversity and not the CEO gender. To conduct the analysis, we perform several regressions on cross-sectional data.

Introduction

Several studies have been conducted on gender diversity in firms. They have focused on different positions in organization including board of directors, labor force, and in a few cases executive managers, chief executive and financial officers (CEOs and CFOs) (Peni & Vahamaa, 2010). The association between gender and a variety of firm characteristics was examined.

The studies in the field of finance and corporate governance have been mostly focused on the effect of the female director on company performance (Carter et al., 2003; Adams & Ferreira, 2009; Gul et al., 2011; Matsa & Miller, 2013; Gregory-Smith et al., 2014), the different management styles of female leaders (Gul et al., 2011; Huang & Kisgen, 2013; Matsa & Miller, 2014), and gender diversity in the boardroom (Adams & Ferreira, 2009; Ahern & Dittmar, 2012; Matsa & Miller, 2013).

In these studies, the company characteristics that appoint female CEOs are not necessarily the main focus of the analyses, but few of them present descriptive statistics on the relationship between the company characteristics (industry, size, age, etc.) and the existence of female CEOs. Therefore, in this paper, we conduct a thorough research on the firm attributes that lead to a female CEO appointment in Norwegian companies. Ultimately, we want to answer the question why there are so few female CEOs.

We examine how firm performance, capital structure, ownership structure, board gender diversity, and size affect CEO gender. Previously, the researchers mostly focused on the reverse relationship or the influence of these factors on the board structure. Therefore, it is interesting to discuss the question the way we propose. Furthermore, we expand the research by examining effects of several ownership types on the CEO gender in comparison to the previous works where only family and state owned firms were discussed.

First, we study the existing literature on the factors relationship with the CEO gender. Then, according to the theories presented in the most influential papers we state the research hypotheses. Next, we discuss the analysis methodology for the cross-section data analysis and explain what kind of regressions we are going to use. Lastly, we describe the data we are going to use,

which is a sample of Norwegian companies in different industries provided by CCGR-database at BI Norwegian Business School.

Literature review

Psychology and management literature have long acknowledged that significant gender-based differences exist, for instance, in leadership styles, communicative skills, conservatism, risk averseness, and decision-making (Vahamaa, 2010). These differences and their implications have received growing attention during recent years and several studies have surveyed women's role and performance in firms.

The ultimate purpose of this paper is to answer the question why there are so few female CEOs. Therefore, we first have to study the factors that influence the CEO being female in the companies. Thus, we review related literature in five parts to address the risk-taking and capital decision making of female executives effect on firm performance, ownership structure, company size, and board of directors gender diversity impact on CEO gender.

Some of the works discuss these factors impact on the board gender diversity. These results are also valuable for us in terms of the methodology used and research expansion.

2.1. Female Executives and Firm Performance

Financial performance is a subjective measure of how well a firm can use assets from its primary mode of business and generate revenues. This term is also used as a general measure of a firm's overall financial health over a given period of time, and can be used to compare similar firms across the same industry or to compare industries or sectors in aggregation. Financial performance analysis is the process of determining the operating and financial characteristics of a firm from accounting and financial statements. The goal of such analysis is to determine the efficiency and performance of firm’s management, as reflected in the financial records and reports (Bhunia et al., 2011).

In this part, the majority of existing literature supports the positive relation between female contribution in executive positions, including CEO, and firm performance in terms of firm's market value, profitability, earnings, and shareholders' wealth. Krishnan & Parsons (2008) found earnings quality is positively associated with gender diversity in senior management. They also concluded that companies with more women in senior management are found to be more profitable and have higher stock returns after initial public offerings than those with fewer women in the management ranks. Another research on CEO gender and firm performance was

conducted by Khan & Vieito (2011). They concluded that firms with female CEOs are associated with an increase in performance compared to the firms managed by male CEOs. Welbourne (1999) also examined the effect of having women on the top management teams of IPO firms on the organizations' short and long-term financial performance. She showed women have a positive effect on the firms' short-term performance (Tobin's Q), three-year stock price growth, and growth in earnings per share. In another study, Francoeur et al. (2008) found that firms with a high proportion of women in both their management and governance systems generate enough value to keep up with normal stock-market returns.

Despite the studies that found positive association between female CEOs and firm performance, some studies did not find a strong relation or proved opposite association. For instance, Peni & Vahamaa (2011) surveyed potential effects of female executives on earnings management. They found no relationship between earnings management and the gender of the firm's CEO. Before Peni & Vahamaa (2011), Woflers (2006) examined the association between stock return and CEO gender using S&P 500 firms over the period of 1992-2004, and found no systematic differences in returns to holding stock in female-headed firms.

In addition to the above-mentioned studies, there are several surveys that investigated the effect of board of directors gender diversity on firm performance. Carter et al. (2003) presented the first empirical evidence examining whether board diversity is associated with improved financial value using data from Fortune 1000 firms. They concluded that there is a significant positive relationship between the fraction of women or minorities on the board and firm value. In another investigation, Erhardt et al. (2003) showed positive relation between board of directors gender diversity and firm performance in terms of profitability using data from 127 US companies. Campbell & Minguez-Vera (2008) investigated Spanish firms and found gender composition of the board can affect the quality of monitoring role and thus the financial performance of the firm; they documented that gender diversity has a positive effect on firm value.

2.2. Female Executives Risk-taking and Capital Decision Making.

Numerous studies have been done in psychology and management about the gender-oriented behavioral differences including risk averseness and

overconfidence. Besides, finance literature includes several researches about the implications of these differences on female corporate decision making in firms.

in gender-oriented behavioral differences and its effect on firm leverage and CEO corporate decision making, we expect to The majority of these studies found that females are more risk averse and have a lower tendency to make risky decisions. Powell & Ansic (1997) surveyed gender risk averseness. They concluded that females are less risk seeking than males and adopt different strategies in financial decision environment, so that these strategy differences may reinforce stereotypical beliefs that females are less able financial managers. In another research Dwyer et al. (2001) found the same relation. They provided evidence that women exhibit less risk taking than men in their most recent, largest, and riskiest mutual fund investment decisions, using data of nearly 2000 mutual funds.

Huang & Kisgen (2011) surveyed male and female executives' overconfidence and showed female executives place wider bounds on earnings estimates and are more likely to exercise stock options early. They concluded men exhibit relative overconfidence in significant corporate decision making as compared to women.

Barber & Odean (2001) analyzed common stock investments of men and women using account data for over 35000 households from February 1991 through January 1997. They documented that men trade 45 percent more than women do, and based on theory that overconfident investors trade excessively, they concluded that men are overconfident as compared to women.

Following mentioned studies on gender difference in risk averseness and overconfidence, there are few studies on the effect of CEO's personal characteristics on their corporate decision making. Cronqvist et al. (2010) empirically showed that firms behave consistently with how their CEOs behave personally in the context of leverage choices. They found a positive economically significant robust relation between personal and corporate leverage. In another survey, Cain & McKeon (2012) studied CEO personal risk taking, corporate policies, and overall firm risk. They document that risk seeking CEOs have higher leverage and greater stock return volatility; besides, sensation seeking CEOs increase overall firm risk through more frequent acquisition activity.

Furthermore, in our specific topic of interest, Faccio et al. (2016) documented that female CEOs tend to avoid riskier investment and financing opportunities. They

also showed firms run by female CEOs have lower leverage, less volatile earnings, and a higher chance of survival than firms run by male CEOs.

2.3. Board of directors gender diversity and CEO gender

The issue of women's participation on the board of directors and in the executive managements of firms is a frequently discussed topic, both in the popular press and in scientific research. The gender diversity of the board has an important role in the recent governance reform efforts worldwide. Nonetheless, the consequences of changing the gender diversity of the board still have to be researched.

There is not so much discussed about the board of directors gender diversity impact on the CEO gender. Mostly the scientific papers focus on another issues which are the impact of a female CEO on the board diversity and the percentage of existing female directors impact on further board gender diversification.

Farrell & Hersch (2005) analyze the determinants and the effects of the appointment of females as new board members in the U.S. They indicate that the percentage of females already on the board has a negative relationship with the likelihood of a female being added to the corporate board.

Adams & Ferreira (2009) suggest that in general even if the female directors have been selected due to tokenism, they have a substantial impact on the board structure.

Parrotta & Smith (2013b) analyze the determinants of female presence on the board of directors in Danish companies and conclude that the companies with a female director on the board have a significantly lower probability of having another female on the board of directors.

Furthermore, Smith et al. (2013) indicate that a female chairman on the board of directors affects negatively the chances of a female promotion to the CEO.

Finally, Adams & Kirchmeier (2013) came to the conclusion that it is not clear that boardroom diversity leads to more women in executive positions.

All these results can be interepreted as evidence of tokenism hypothesis, which implies that individuals whose social category is underrepresented in particular contexts will face negative experiences such as increased visibility and social isolation (Kanter, 1977).

On the other hand, Bilimoria (2006) reports that there is a positive relationship between the presence of women corporate directors and the representation of

women executives in Fortune 500 top management teams. The findings of this study empirically support the notion that women corporate board directors and top management gender diversity are positively related. It is stressed that corporations that want to improve the gender diversity of their senior management team would do well by also enhancing the gender diversity on their boards.

Furthermore, several reports of Catalyst (1993, 1995, 2004, 2005, 2007, 2007) and Joy (2008) showed a clear and positive correlation between the percentage of women board directors in the past and the percentage of women corporate officers in the future. In addition, Matsa & Miller (2011) and Elkinawy & Stater (2011), who performed analyses among the listed U.S. companies, also found a positive spillover effect of the presence of female board members on the probability of having female top executives.

Soares et al. (2012), who studied the relationship between the percentage of company`s women board directors in 2001 and the percentage of women corporate officers of the same company in 2006 among the Fortune 500 companies, confirmed their results. Amore et al. (2014) found consistent results that female CEO boards have fewer directors, are most importantly more gender diversified, also more independent, have better director attendance, and have higher overall board monitoring index. They also showed for family-controlled firms in Italy that companies led by female CEOs perform significantly better with increasing numbers of women on the board of directors.

Furthermore, Charles et al. (2015) showed that firms with at least three women on boards are more likely to be run by a female CEO. This result is significant because it demonstrates that the presence of women in positions of visible authority may encourage and support effective representation of women on boards.

Frye & Pham (2015) found out that female directors have a substantial and valuerelevant impact on board structure. However, they highlighted that this evidence did not provide support for quota-based policy initiatives. No evidence suggested that such policies would improve firm performance on average.

The effectiveness of quotas has been debated in some countries. Although the targets for female representation on boards in Norway have been met, unfortunately, the appointed female board members were often inexperienced and did not create additional value (The Economist, 2011). Currently, Norway has approximately 40%

female representation in the boards of directors. However, there are still quite few women in top executive positions. Therefore, it should be admitted that board gender quotas are not in themselves sufficient to get more women in executive positions, but the law has most likely contributed to helping Norwegian women start the changes (Fosen, 2013).

Seierstad et al. (2010) showed that a substantial increase in the proportion of women on boards in Norway occurred only during the implementation period of the gender representation law, and especially towards the end of that period. This suggested that the law had successfully challenged the under-representation of women on boards of public limited companies, and made the boards more balanced in terms of gender. In addition, women's access to the most senior positions within boards remained restricted as the share of companies with a woman chair has remained low and stable after the implementation period. At this time though, the research indicated that, while women participation has increased, senior positions remain restricted to men.

2.4 Ownership structure and CEO gender

Much of the debate and analysis is focused on the effect of gender diversity on firm performance in larger, often listed companies (Carter et al., 2003). The quota laws in Norway and in other countries have also been enacted to include only listed firms. As a consequence, the largest share of companies within the economy has been excluded both in the public debate and in the academic research.

Bohdanowicz (2015) performed an analysis for polish companies and got several results regarding ownership concentration impact on the board diversity. First, there is a positive relationship between managerial ownership and supervisory board diversity since owner-managers appoint to the supervisory boards members of their families, including women. Thus, they increase gender diversity in the boardroom, but without the utilization of the advantages of gender diversity. Second, there are positive relationships between state ownership and board diversity since companies with state ownership could take advantage of gender diversity in the boardroom. Third, there is a negative relationship between financial investors' ownership and supervisory board diversity.

According to Morikawa (2014), listed and long-established companies, subsidiaries, and unionized companies tend not to have female directors. On the other hand, owner-managed companies are likely to have female directors and CEOs. However, in the owner-managed companies, those from the founder's family including spouse and daughter have a greater chance to become director, and in some cases, they are promoted to CEO through the succession among family members.

Sekkat et al. (2015) wondered whether factors linked to ownership and corporate governance could explain why some firms in the developing world are more reluctant than others to hire female CEOs. They discovered that ceteris paribus, when the dominant shareholder is a woman, the CEO is also much more likely to be a woman. Bjuggren et al. (2015) showed that female leadership is more common in family than in non-family corporations. In contrast, Eklund et al. (2009) empirical analysis showed that ownership concentration does not affect board size or board composition.

2.5 Company size and CEO gender

Du Rietz & Henrekson (2000) analysed the influence on firm performance from women on boards for Swedish firms. They stress the importance of controlling for firm size and sectors. In addition, Smith et al. (2005) highlighted that the size of the firm is frequently used as a control variable in financial performance analysis since it may correlate with the percentage of females on boards. In terms of company size, studies in the U.S. generally found that the company size is positively associated with the number of female directors (Carter et al. 2003; Farrell & Hersch, 2005; Adams & Ferreira, 2009; Gul et al., 2011).

Charles et al. (2015) results show that the likelihood of the development of a critical mass of women on a specific board increases with firm size. This is consistent with Agrawal & Knoeber (2001), Hyland & Marcellino (2002), Carter et al. (2003), and Wang & Clift (2009) who also showed a positive relation between firm size and the percentage of women directors.

An exception is the paper by Bertrand & Hallock (2001), which indicated that the size of companies with female directors is relatively small. Moreover, Morikawa (2014) concluded that the company size and foreign shareholdings do not have significant relationships with the presence of female directors. Regarding female

CEOs, Wolfers (2006) suggested that the size of the companies with female CEOs is slightly smaller than with the male counterparts.

However, there is a difference with respect to size of the company (number of employees) between companies led by a female CEO and companies led by a female chairperson on the board of directors. The latter companies tend to be smaller, while companies with a female CEO tend to be larger than the full sample (Parotta & Smith, 2013a).

Theory

Hypothesis 1

According to the support of the relation between female contribution in executive positions, including top management, CEO, board of directors, and firm performance in the literature, we expect to find the same relation in our study. Considering existing related literature (Krishnan & Parsons, 2008; Khan & Vieito, 2011; Welbourne, 1999; Francoeur et al., 2008); Carter et al., 2003; Erhardt et al., 2003; Campbell & Minguez-Vera, 2008), we base our theory for this part on Khan & Vieito (2011) research and define our hypothesis as following.

Hypothesis 1:

"Firms with a female CEO have better financial performance than those with a male CEO."

Hypothesis 2

Previous literature has found that females are more risk averse (Powell & Ansic, 1997; Dwyer et al., 2001) and CEO personal behavior affects his/her corporate decision making and firm leverage (Cronqvist et al., 2010; Cain & McKeon, 2012). According to these findings, it is expected that female CEOs, as risk averse CEOs, make more conservative corporate decisions and have a lower leverage which is supported by Faccio et al. (2016) study. In our thesis research, we follow Faccio et al. (2016) study's results and expect to prove the following hypothesis.

Hypothesis 2:

"Female CEOs are less risk seeking than male CEOs. Consequently, firms with female CEOs have a lower leverage and lower return volatility than firms with male CEOs."

Hypothesis 3

The recent research mostly agrees that there is a positive relationship between the presence of women directors on board and the representation of women executives. Bilimoria (2006), Soares et al. (2012), Amore et al. (2014), Matsa & Miller (2011), and Elkinawy & Stater (2011) empirically support the notion that the probability of having a female CEO in the firm increases with the percentage of women corporate board directors increase. It leads us to the next hypothesis we would like to test for the Norwegian companies.

Hypothesis 3:

"*The number of women directors on a corporate board will be positively associated with the number of women in top executive officers positions."*

Hypothesis 4

The literature on the firm ownership impact on the CEO gender is quite scarce. Most of the research is related to the listed companies. Listed and long-established companies do not tend to have female CEOs (Morikawa, 2014). We can rely on the papers suggesting that state and family owned companies tend to assign female CEOs (Bohdanowicz, 2015; Bjuggren et al., 2015). Importantly, we should take into account the quota law in Norway that resulted in the relatively higher increase of female CEOs in listed than in family firms according to the data observations. Furthermore, taking into account Sekkat et al. (2015) we can analyze whether truly female owners tend to have female CEOs in their companies. All these works are unique and are not supported by numerous research papers which might be due to complicated data gathering.

We have data on all ownership types for Norwegian companies, including international ownership, female ownership, industry institutional ownership, family ownership, and CEO belonging to the family data. Therefore, we can test all these factors influence on the CEO gender and construct several hypotheses.

Hypothesis 4.1:

"State ownership is positively related to female CEO appointment." **Hypothesis 4.2:**

"Female CEOs tend to be appointed in the family owned firms."

Hypothesis 4.3:

"Female owners tend to assign female CEOs."

Hypothesis 4.4:

"International owners do not have major impact on the CEO gender."

Hypothesis 4.5:

"The increase in female CEOs of non-family companies was higher after quota policy launching that the increase of female CEOs in family firms."

Hypothesis 5

The researchers agree that size of the company is an important control variable. We are planning to use the number of employees as the size variable. However, it is also interesting if it can be an independent factor that itself influences significantly the CEO gender.

The recent papers mostly discuss the positive influence of the firm size on the number of female directors. This can be tested also for the impact on CEO gender. Moreover, Parotta & Smith (2013a) found that companies with a female CEO tend to be larger than the full sample. Therefore, it will be consistent for us to offer another hypothesis for the Norwegian companies.

Hypothesis 5:

"The size of the company has positive effect on the CEO being a female."

Methodology

The data we use is cross-sectional. Therefore, we could undertake series of linear and logistic regressions to determine the relationship between the firm characteristics and CEO gender. Logistic regression is the appropriate regression analysis to conduct when the dependent variable is dichotomous (binary) as it is in our case, e.g. CEO gender. Like all regression analyses, the logistic regression is a predictive analysis. This regression is used to describe data and to explain the relationship between one dependent binary variable and nominal, ordinal, interval, or ratio-level independent variables.

To estimate the influence of every firm characteristic that we base our hypotheses on we would run different regressions. We have grouped the data into five categories according to the hypotheses. We would run linear and logistic regressions for every group of factors to calculate the probability of the CEO being female.

First, in order to estimate the firm performance influence on the CEO gender we use "income before extraordinary items" variable as the main independent variable in our regression. We also should control for other variables in this part.

Second, to test for the second hypothesis, we use leverage and volatility of returns related variables in the regression, e.g. leverage (financial debt/debt+equity), return on assets, to prove the second hypothesis.

Third, we estimate whether percentage of female CEOs has impact on the CEO gender. Here we use the logit transformation for the CEO gender as dependent variable and the variables on board size, number of female directors on board, or proportion of females on the board as independent variables. There would also be control variables.

Fourth, for every ownership type we run separate logistic regressions with CEO gender logit transformation as dependent variable using independent variables of firm aggregate fractions owned by institutional, female, family, state, international, personal owners respectively. We would also have to control for the size, industry, and profitability of the companies.

Finally, we would like to estimate if the size of the company as independent variable influences the CEO gender. We should control for the company profitability and industry here.

Data

We use the data for Norwegian companies in different industries provided by CCGR-database at BI Norwegian Business School.

The original data set contains data of approximately 3.2 million companies. However, not all of the companies in the data set provided have information on the CEO gender. Therefore, we had to filter the data and exclude firms with no information on CEO gender, which left us with 2.2 million companies. Furthermore, we excluded the firms with *zero* value in assets or sales from our data set. This is due to the fact that there are personally owned companies in Norway that people open to provide services like consulting apart from the employment. These companies often might not have income and assets. Therefore, we would like to exclude them to lower the possible biases in our analysis.

Moreover, to analyze the relationship between firm performance, board gender diversity, and female CEOs appointment we had to calculate and add several other variables, e.g. total debt, female directors proportion.

The independent variable for most of the analysis would be the CEO gender or its logit transformation. We have to group the dependent variables into five categories according to our hypotheses. The full list with definitions of the variables is Exhibit 1 in the appendices.

For each of the tests conducted, we have to control for a variety of possible factors that might have impact on the CEO gender. These are the control variables like company size, company profitability, industry type, industry profitability, size of the top management team, and size of the board. While the study also includes separately hypothesizing the individual effects of several of these variables on the CEO gender, it is of great importance to address these possible influences so that the explanatory effect could be determined after controlling for them.

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Appendices

Exhibit 1. Variables definition

Variable	**Definition**
item_2	CEO gender
item_9	Revenue
item_63	Total fixed assets
item_78	Total current assets
item_87	Total equity
item_d	Total debt
item_35	Income for extraordinary items
item_62	Board size
item_605	Number of female directors
item_fdp	Female directors proportion
item_11102	Industry code
item_15006	Enterprise type
item_50109	Number of employees
item_13601	Share owned by CEO
item_14011	Equity held by ultimate owners with rank 1
item_14018	Aggregated fraction held by industry institutional owners
item_14019	Aggregated fraction held by personal owners
item_14021	Aggregated fraction held by female owners
item_14022	Aggregated fraction held by state owners
item_14023	Aggregated fraction held by international owners
item_15302	Largest family sum ultimate ownership
item_15304	Largest family has CEO