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Gender Diversity Among Top Executives and Firm Financial Performance

Empirical evidence from Norwegian-listed firms 2010-2016

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Abstract

There exists a gender gap in top executive positions today. Research has shown that gender diversity may have a positive impact on firm financial performance. This thesis aims to investigate the relationship between gender diversity among top executives and firm performance. In particular, we ask the following research question: *What impact does gender diversity among top executives have on financial performance for Norwegian listed firms?* In this context, gender diversity is defined as representation of both genders among the CEO and CFO of a firm. We examine whether gender diversity is positively linked to firm performance, as measured by return on assets (ROA) and return on equity (ROE). In addition, we investigate whether female top executives outperform their male counterparts.

Based on panel data of 93 Norwegian-listed companies from 2010 to 2016, we use multiple regression analysis to examine the gender-performance relationship. By controlling for firm- and executive-level characteristics, we are able to compare gender diversity effects across firms. The results indicate no significant relationship between gender diversity among top executives and firm performance. Further, we find that, on average, firms led by female CEOs tend to outperform firms led by male CEOs. Finally, we find no significant evidence of a relationship between the gender of the CFO and firm performance.

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1. Introduction

Increased globalization and competition in global markets has contributed to a more heterogeneous workforce in terms of gender, age, and cultural characteristics (Miller & Richard, 2013). The female labor participation rate has increased during the last century, and this has led to a stronger presence of gender diversity in the workforce (OECD, 2004). In a study of 279 US companies, McKinsey & Company (2018) found a female participation rate on entry level of 48.1 percent. However, they also found that the share of jobs held by women tend to shrink with every step they advance through the corporate ladder[1]. Women are scarce among senior leaders of the largest corporations. As of June 2019, a disproportionately small share of 6.6 percent of the Fortune 500 companies will have a female CEO (Fortune, 2019). Although this share represents a considerable increase from the previous year, where the female share was 4.8 percent, there still is an apparent underrepresentation of women in higher management positions.

The value-in-diversity perspective suggests that a diverse workforce is beneficial for business, through higher corporate profits and earnings (Herring, 2009). Hofhuis, van der Rijt, and Vlug (2016) found that organizations with a strong *diversity environment*[2] are more likely to have better job satisfaction and knowledge sharing amongst employees. Boehm, et al., (2014) argue such environments are linked to reduced discrimination. Studies show that retention of talent, increased innovation, and better reputation seem to have a positive link to high level of gender diversity (Ali, Metz, & Kulik, 2015; Lorenzo, et al., 2017; Weber Shandwick, 2016).

There are still several barriers between women and their labor participation, especially in senior positions (McKinsey & Company, 2018). Barriers associated with the *glass ceiling*[3] and *glass cliff* [4] as well as the relatively recent development of the #metoo[5] movement have thrown a glaring spotlight on the gender gap and discrimination in the workplace. On a global

[1] The *corporate ladder* refers to the following six levels and their respective female participation rates: entry level (48.1 percent), manager (38.4 percent), senior manager/director (34.1 percent), vice president (29.4 percent), senior vice president (22.7 percent), and C-suite (22.4 percent).
[2] *Diversity environment* in this context refers to the presence of diverse work cultures and is measured by the degree of openness and appreciation towards others regardless of individual differences.
[3] The *glass ceiling* refers to gender disadvantages being stronger at the top of the corporate hierarchy than at lower levels (Cotter, Hermsen, Ovadia, & Vanneman, 2001).
[4] The *glass cliff* refers to the phenomenon of women being more likely than men to achieve leadership positions during downturns or crisis, when the chance of failure is high.
[5] The #Metoo movement is a movement against sexual harassment and sexual assault. The movement caught viral attention in October 2017 after sexual-abuse allegations against the American film producer Harvey Weinstein.

level, women continue to suffer from the gender wage gap, and there has been little improvement since 2010 (OECD, 2017, p. 153). Kunze (2016) provides evidence that entitlement to extended leave harms both wages and employment rates. Policies related to parental leave pose as a potential explanatory factor for discrimination against women and mothers in some areas of work (Kunze, 2016). Joshi and Roh (2009), and Parrotta, Pozzoli and Pytlikova (2014) found negative attitudes like prejudice and discriminatory behavior linked towards women in the workforce. Mitigating initiatives have been implemented to reduce the presence of the barriers women face in their career. Policies such as paid parental leave, subsidies for child care and laws relating to gender-specific anti-discrimination have contributed to decreasing the gender gap in the workplace (OECD, 2004). Yet, the gender gap persists.

Our study aims to investigate the relationship between top executive gender diversity and firm performance. We study Norwegian listed companies in the period from 2010 to 2016. Following Konrad (2003), we advocate a definition of diversity which emphasizes intergroup interaction, and is inclusive of differences, rather than being focused on individual differences.

Drawing from the preceding introduction, our study attempts to answer the following research question:

> *What impact does gender diversity among top executives have on financial performance for Norwegian listed firms?*

In congruence with the research question, the objective of this research is to investigate the relationship between top executive gender and firm financial performance. We refer to *top executives* as a grouping of the CEO and CFO of a firm. Thus, when referring to an executive, we refer to CEOs and/or CFOs. In our study, top executive gender diversity refers to a state where a firm has either a female CEO and a male CFO, or a male CEO and a female CFO. *Financial performance* is operationalized by the accounting measures ROA and ROE, and is henceforth referred to as firm performance. We employ regression analysis to investigate the relationship between top executive gender diversity and firm performance. The empirical analysis uses firm-level accounting data for measuring firm performance. Further, executive-level data is used for measuring top executive gender diversity. We control for characteristics related to firms and executives, which makes it possible to compare firm performance and executive gender diversity across firms.

Few social phenomena have attracted as much attention in the late twentieth and early twenty-first centuries as that of diversity and gender equality. Our contribution to the growing literature on gender diversity is twofold. First, we study the firm performance relationship from a top executive level, including both the CEO and the CFO. Second, by examining longitudinal data from 93 listed Norwegian companies between 2010 and 2016, we study this relationship in a Norwegian context. Little attention has been paid to the position of the CFO in the context of top executive gender diversity and firm performance. Surveying CFOs from publicly listed- and governmental entities in Australia, Sharma and Jones (2010) finds that the traditional role of the CFO, reporting to higher level management the financial performance and risks of the organization, is changing and that the value-creating activities of the CFOs are increasingly tied to the overall strategy of the firm. Han, Zhang and Han (2015) argue that the nature of the strategic partnership between the CEO and the CFO can influence firm performance.

Gender diversity is interesting from a Norwegian perspective as it is a leading country in gender equality in many regards. Norway ranked second of 149 countries in the World Economic Forum´s Gender Gap Index in 2018, and has held up internationally as an example of a pioneer in gender quality measures (World Economic Forum, 2018). However, as of March 2019, 14 out of 211 Norwegian-listed companies are run by women - 6.6 percent of the total in this respect. This gender gap is referred to as a paradox of national importance by the Norwegian minister for children and equality, Linda Hofstad Helleland. In an interview with the Financial Times (2018), she stated: *"When I took over as minister I asked: why are we doing so bad when it comes to women and equality at the top of the private sector and business life? It's not just important because I think women should be CEOs, it's also important for the welfare of Norway. If we're going to maintain our welfare into the future, we need the best people at the top of our companies. Why are we using only half of our population?"*

The remainder of the thesis is structured in the following manner. Following the introduction, Chapter 2 provides an overview of the empirical literature examining the link between gender diversity and firm performance. Chapter 3 describes the data and the sample selection process. Chapter 4 outlines the methodology applied in the empirical analysis. Chapter 5 presents the estimation results from the regression analysis. Chapter 6 discusses the findings from the analysis, followed by suggestions for future research. Chapter 7 concludes the findings of our study.

2. Literature review and hypothesis development

In this chapter, we discuss and summarize empirical results from previous literature within the field of gender diversity and firm performance. Followed by this, we introduce the hypotheses which will be tested in the empirical analysis.

2.1 Gender diversity and firm performance

Empirical support for the exact link between gender diversity in top management and firm performance has, in general, been inconsistent (Williams & O'Reilly, 1998). While some studies suggest a positive relationship between gender diversity in top management and firm performance, others find both negative and non-significant relationships (see for example Krishnan & Parsons, 2008; Ancona & Caldwell, 1992; Shrader, Blackburn, & Iles, 1997). There are several potential explanations for why the results have remained inconsistent. Joecks, Pull, & Vetter (2013) suggest aspects of the sample (such as size and demography), time horizon of the sample investigated, and methodology may explain some of the inconsistency. An additional explanation is that studies tend to vary in terms of measurements of gender diversity and firm performance.

The most common measure of gender diversity among the investigated literature is a proportion measurement, where diversity is measured on a scale from 0 to 1, where 1 represents 100 percent female representation in a group (see for instance Adams & Ferreira (2009), and Krishnan & Parsons (2008)). A weakness of using proportion of women in a group as proxy for gender diversity is that it does not take into account levels of heterogeniety.

A majority of the studies included in the literature review use short-term accounting measurements of firm performance such as return on assets, return on equity, return on investment and return on sales (see for example Erhardt, Werbel, & Shrader, 2003; Smith, Smith, & Verner, 2006). A drawback of using these measures is that they measure *past* firm performance. Some studies supplement accounting measures with market measurements of firm performance by using e.g. stock performance or Tobin´s Q (see for instance Adams & Ferreira, 2009; Krishnan & Parsons, 2008).

2.2 Reviewed literature

The reviewed literature examines the relationship between gender diversity and firm performance. Our study investigates gender diversity at the top executive level and focuses on the CEO and CFO in particular. We also review literature examining the strategic partnership between the CEO and CFO. Further, we look at findings from the psychology literature to better understand how men and women may differ from one another, and how the differences can be relevant from a firm performance perspective.

2.2.1 Gender diversity and firm performance

Literature concerning the relationship between gender diversity and firm performance is a relatively new area of inquiry (Khan & Vieito, 2013). A number of studies have found a significant positive correlation between gender diversity in top management and firm performance (see for example Finkelstein, Hambrick, & Cannella, 1996; Erhardt, Werbel, & Shrader, 2003). Research suggests that diversity may enhance the breadth of perspectives, cognitive resources, and overall problem-solving capacity of a team (Bantel & Jackson, 1989; Hambrick, Cho, & Chen, 1996; Smith K. , et al., 2003).

According to upper-echelons theory, top management (i.e., senior-level managers) have a significant impact on financial firm performance due to their autonomy to make important decisions for the company (Finkelstein, Hambrick, & Cannella, 1996). Krishnan and Parsons (2008) found that firms with a high degree of gender diversity were associated with better performance compared to that of firms with a lower degree of gender diversity. Further, they found that firms with a higher proportion of women in top management were associated with higher stock returns after initial public offerings. Based on examinations of Fortune 500 companies, Erhardt, Werbel and Shrader (2003) found that firms with a higher ratio of female on board yielded higher returns on assets and return on investment, relative to the average of the sector in which they operated. In a panel study of 2,500 Danish firms, Smith, Smith and Verner (2006) found a positive correlation between the proportion of females in top management positions and firm performance. However, the correlation was significant only to the extent where the female top managers had a university degree.

Research on top management level reports contradicting results when examining the gender diversity-performance relationship. For instance, Ancona and Caldwell (1992) and Murray (1989) report a negative relationship between heterogeneity amongst top management teams and firm performance. They argue diverse teams in top management are more costly and difficult to coordinate and control, relative to that of homogeneous teams. In a study of 200 U.S. companies, Shrader, Blackburn & Iles (1997) found no significant relationship between a higher proportion of females in top management and firm performance.

A number of studies advocate a contingency approach, examining factors that interact with diversity, when investigating the relationship between diversity and firm performance. For instance, Jackson (1992) suggests gender diversity is beneficial for novel tasks, and not for standardized routine tasks. Richard & Johnson (1999) argue that a positive effect between firm performance and diversity is more likely to be realized when firms' strategies and cultures are compatible. Williams & O'Reilly (1998) argue that gender diversity in management ranks may contribute to better firm performance in certain contexts where variety of perspectives and creativity is valued. In addition, Dwyer, Richard, and Chadwick (2003) suggest that the impact of gender diversity is contingent on the organizational context, and that gender diversity in management is likely to enhance firm performance for firms seeking growth. Furthermore, in a study of public U.S. companies, Dezso and Ross (2012) found that female representation in top level management would lead to higher firm performance only if the firm integrated innovation as a key part of its strategy.

In sum, the investigated literature on gender diversity and firm performance is mixed. Upper-echelons theory and a number of empirical studies suggest that having a mix of women and men in top management positions is associated with higher firm performance. Furthermore, several studies suggest that gender diversity is linked to higher firm performance contingent on several contextual factors such as the nature of the task and organizational context (Dwyer, Richard, & Chadwick, 2003). Ancona and Caldwell (1992) suggest a negative relationship, where heterogeneity in top management is assumed to be related to higher costs impeding firm financial performance.

A weakness of the literature is that most of them study the gender diversity-performance relationship in U.S. companies. Considering the findings from Richard and Johnson (1999) and culture in the context of the contingency approach, the findings may therefore be less representative in a Norwegian setting.

2.2.2 Women in top management

In a panel study of U.S. companies, Khan and Vieito (2013) studied whether companies led by female CEOs were at the same level of operational and financial performance as companies led by male CEOs. They found that CEO gender affected the performance outcome of their sample, and suggest that firms managed by female CEOs tend to be associated with better firm performance compared to firms managed by male CEOs. In addition, they also found a greater level of risk within companies with male CEOs relative to that of female CEOs.

A number of studies in the psychology literature suggest that women are better equipped with skills related to communication, problem-solving, teamwork and decision-making (Fondas, 1997; Maznevski, 1994; Schubert, 2006; Robinson and Dechant, 1997). Based on a study of 84 Irish companies, Brennan and McCafferty (1997) argue that female executives have a better understanding of consumer behavior and needs, which yields a competitive advantage for firms controlled by females. King and Cornwall (2007) further add that the competitive advantage described in Brennan and McCafferty (1997) is significant in particular industries where products or services offered are mainly targeting females as women are better suited to understand behaviors and needs of female consumers.

In sum, the investigated literature relating to women in top management suggests that females, in general, might be better than men at communicating, solving problems, making decisions and working in teams. A potential weakness is that these female traits may have a significant effect only in particular industries (Brennan & McCafferty, 1997).

2.2.1 Strategic relationship between CEO and CFO

Research indicates that top management teams have a significant influence on firm performance (Certo, Lester, Dalton, & Dalton, 2006). Further, the same research also argues how the academic community and the financial media assigns importance to characteristics of the executives being part of the top management teams. While the constituents of top management teams tend to vary across studies, the CEO and CFO are often seen as the two highest ranking executives of the management team in the organizational hierarchy (Strand, 2013).

Six, Normann, Stock and Schiereck (2013) studied the outcomes of managerial discretions for German CEOs and CFOs to assess whether they affect firm performance. They find evidence that CEOs and CFOs have a substantial impact on corporate policies and firm performance, and that CEOs are more influential than CFOs in general. In addition, they find that the geographical context in which the firm operates affects the influence of the CEOs and CFOs. For this last point, they emphasize the strong differences in corporate governance between countries. Previous research has mainly been focused on the U.S., where the primary focus has been on the influence of the CEO. CEOs influence on firm performance were smaller in Germany compared to comparable U.S. studies (Six, Normann, Stock, & Schiereck, 2013).

Han, Zhang and Han (2015) studied the effects of CFOs as strategic partners of CEOs and how the strategic relationship could influence the firm's financial performance. They argue value-creating activities of CFOs have an impact on ROA. Their argument is supported by a discussion of how CFOs can provide thorough risk assessments and insights into the financial viability of strategic positions, and combine this with their knowledge of the underlying economics of the firm to enhance ROA.

There seems to be a consensus among researchers towards top management teams having an influence on firm performance. Both the CEO and CFO seem to be an integral part of the decision making within firms. Although there is evidence of CEOs being more influential than CFOs in general, some studies have indicated that CFOs might also have an important influence on firm performance.

2.3 Hypothesis development

The preceding literature on gender diversity and firm performance is mixed. Several of the investigated studies provide evidence of a positive gender-diversity relationship (Erhardt, Werbel, & Shrader, 2003; Khan & Vieito, 2013; Smith, Smith, & Verner, 2006). Some studies advocate a contingency approach, suggesting for the relationship to be dependent on contextual factors such as organizational culture and industry (Jackson, 1992; Richard & Johnson, 2001; Williams & O'Reilly, 1998; Dwyer, Richard, & Chadwick, 2003; Dezso & Ross, 2011). We also find literature with contradictory results suggesting non-significant or negative relationships (Shrader, Blackburn, & Iles, 1997; Ancona & Caldwell, 1992). Based on results from Erhardt, Werbel, & Shrader, 2003, Khan & Vieito, 2013, and Smith, Smith, &

Verner, 2006, our initial expectation is that there exists a positive relationship between gender diversity and firm performance for our sample. Based on this, our first null hypothesis is proposed:

Hypothesis 1: *Firms characterised as diverse perform better, on average, than firms characterised as non-diverse.*

As of today, there is evidence of a growing advocacy for hiring female CEOs as part of the corporate strategies to enhance sustainable development (Bear, Rahman, & Post, 2010). The relationship between gender of the CEO and firm performance is still a relatively unexplored area of literature (Khan & Vieito, 2013). We supplement the field by examining this relationship in a Norwegian context. Based on the characteristics of women described in Fondas, 1997, Maznevski, 1994, Schubert, 2006 and Robinson and Dechant, 1997, we expect firms led by female CEOs to perform better, on average, relative to that of firms managed by male CEOs. Thus, our second null hypothesis is proposed:

Hypothesis 2: *Firms managed by female CEOs perform better, on average, than firms managed by male CEOs.*

To our knowledge, little attention has been paid to the relationship between CFO gender and firm financial performance in the literature. Based on the research by Han, Zhang and Han (2015) concerning the strategic partnership between the CEO and CFO, as well as the evidence provided by Six, Normann, Stock and Schiereck (2013) suggesting that the CFOs might have an impact on firm performance, we find it reasonable to assume that the same arguments proposed for female CEOs, above, should be applicable for female CFOs. Hence, our third null hypothesis is proposed:

Hypothesis 3: *The performance of firms with female CFOs is better, on average, than that of firms with male CFOs.*

3. Data

In the following chapter, we present the data used in the empirical analysis. The chapter consists of four main parts. The first part provides an overview of the sources of our final data set. In the second part, we describe and discuss the sample selection process. The third part provides a description of the variables and a discussion of their relevance for our research. The last part provides a presentation of our final sample through descriptive statistics.

3.1 Sources

The final data set consists of *firm-level data* from the Institute for Research in Economics and Business Administration[9] (henceforth SNF), and *executive-level data*, which is collected by hand. The firm-level data consists of accounting data and accompanying firm characteristics. The executive-level data consists of detailed characteristics related to top executives. Together, the two parts include i) firm-level data concerning firm performance, firm size, firm age and industry, and ii) executive-level characteristics covering age, tenure, education and gender of the CEO and CFO. The final dataset is a balanced panel covering 93 publicly traded Norwegian firms on *Oslo Børs*[10] over the period from 2010 to 2016. In total, this amounts to 651 observations.

3.1.1 Firm-level data

The firm-level data is retrieved from the SNF database, which contains accounting- and company information for Norwegian companies dated from 1992 to 2016[11].[12] The database consists of annual and consolidated financial statement files, and files containing company information. Combined, they provide firm-level accounting data and company characteristics such as legal form and industry. The SNF database plays a crucial role in providing data for

[9] Norwegian: "Samfunns- of næringslivsforskning".
[10] Oslo Børs is the central marketplace for listing and trading of financial instruments in the Norwegian market. Oslo Børs offers the only regulated markets for securities trading in Norway today.
[11] The database is updated annually. As of the date of publication of the thesis, observations from 2016 are the most recent provided by SNF.
[12] Brønnøysundregistrene (state administration agency) provides annual data for the SNF database through Bisnode D&B Norway AS in cooperation with Menon Business Economics AS (Berner, Mjøs, & Olving, 2016).

our computations of firm performance (ROA and ROE). Further, the database provides measures for the firm-level control variables used in the empirical analysis. An overview of all firm-level variables collected from the SNF database is provided in Table A1 found in appendix A.

3.1.2 Executive-level data

The executive-level data is retrieved by combining information from each firms' official website, company filings and ATEKST[13]. These sources allowed us to gather information on individual characteristics of the top executives within each firm. Currently, there are no sources providing standardized data on characteristics of Norwegian top executives. The hand-collected executive-level data contains unique information of executive-level characteristics such as tenure, age, education, and gender. We found such information necessary for investigating the relationship between top executive diversity and firm performance. Controlling for characteristics which may explain some of the variation of executives provided an opportunity to investigate the effect of diversity and gender, holding other factors constant.

Following the sample selection process (further described in chapter 3.1.3), we used the final list of 93 companies as an initial starting point for gathering the data. By searching for each firm in ATEKST, we found previous news articles concerning the firms in question. By further filtering our search through the years of 2010 to 2016, we found an extensive overview of all top executives seated in the period. Furthermore, we investigated each firms' website and company filings for information related to the executive's year of birth, education, and date of appointment in role. Year of birth and date of appointment allowed us to compute their age and tenure. An overview of all executive-level hand-collected variables is provided in table A2 in appendix A.

[13] ATEKST is Scandinavia´s largest digital news archive.

3.2 Sample selection

Our final sample includes observations of 93 publicly listed Norwegian firms from 2010 to 2016. One observation is equivalent to all relevant data points on one firm for one fiscal year. Thus, the final sample consists of 651 observations. Table 3.1 outlines the selection criteria applied for arriving at our final sample. In particular, the choice of *Norwegian listed firms* and the *time period* is of essence for understanding the rationale for the selection criteria.

The rationale for sampling Norwegian listed firms is backed by two arguments; availability and time restrictions. Firms listed on Oslo Børs are legally required to report and announce their financial statements each year to the public.[14] Thus, firm-level data is reported in a standardized way, making it easily accessible. Furthermore, as the firms are publicly traded, they generally obtain more attention[15] in the media, relative to that of non-listed firms. Hence, information concerning listed firms and its' executives is more easily available in the news archives (ATEKST). Time restrictions played a crucial part in the choice of concentrating on listed firms. Considering the fact that we wanted to measure gender and diversity effects on top executive level, focusing on listed firms provided a manageable number of observations for collecting the desired data given the scope of time available for writing the thesis.

We study a seven-year horizon mainly due to avoidance of bias from short term trends and the fact that it enriches the total number of observations. The specific years of 2010 to 2016 were determined due to restrictions on both upper and lower limits of years to choose from. Due to relevance considerations of the empirical research, we wanted to study the most recent timeframe possible. The SNF database provided data available up until 2016, hence 2016 acted as an upper limit. We selected 2010 as a lower limit mainly in order to avoid the data from being highly affected by the financial crisis of 2008.

[14] The legal requirements are described in the Securities Trading Act (Finanstilsynet, 2015).
[15] The increased attention being due to the fact that the demand from information concerning listed companies is arguably higher, as investors are incentivized to trade securities based on information.

Table 3.1 – Sample selection process

	Removed obs.	Remaining obs.
Observations in the SNF database from 2010 to 2016		1,939,380
1) Removing inactive firms	91,542	1,847,838
2) Removing firms without the legal forms ASA or SPA	1,845,368	2,470
3) Removing firms not listed on Oslo Børs from 2010 to 2016	1,847	623
4) Removing firms entering Oslo Børs through IPO in 2010	42	581
5) Removing firms involved in merger or acquisition	35	546
6) Removing holding companies with no employees	7	539
7) Removing firms liquidated after 2016	7	532
8) Cross-check with "Børsprosjektet"	(119)	651
Final sample		*651*

In step 1, we remove inactive firms due to their lack of observations on several accounting variables. In step 2, we remove firms not categorized by the legal form ASA (public company) or SPA (savings bank). We keep savings banks as some of them have equity certificates listed on Oslo Børs. In step 3 we remove firms being *partly* (not consistently) listed through the period of interest (2010-2016). Furthermore, in step 4, we remove firms who entered Oslo Børs through an IPO[16] in 2010, and in step 5, we remove firms involved in mergers or acquisitions during the sample period. Such events are often associated with significant changes for the parties involved from an organizational perspective and can have a significant impact on the outlook of the combined entity. In step 6, we remove a holding company with no employees as they do not involve directly in operations. In step 7 we remove a firm that was liquidated after 2016, due to poor access of data on the executive level available.

In step 8, we use data from *Børsprosjektet*[17] as a cross-reference. We do this in order to ensure the exhaustiveness of the selection process described in steps 1 through 7. We apply steps 1 through 7 on the Børsprosjektet database, and find 17 additional firms (119 observations) not being picked up by the selection process using the SNF database. Of these, 15 firms were savings banks that was wrongfully lost in step 3 of the initial selection process. These firms

[16] Initial public offering.
[17] Børsprosjektet is a source of financial data provided by the Norwegian School of Economics. It covers stock market data such as daily and monthly stock prices for listed companies on Oslo Børs from 1980 to date.

had missing data in the SNF database for a variable indicating whether the firm was listed on the exchange or not.

After completing all 8 steps of the sample selection process, we end up with a final sample of 651 observations, translating to 93 firms observed in each year from 2010 to 2016.

3.3 Variable description

In this section we explain the variables used in our study and discuss their relevance. First, the dependent variables are presented, followed by the independent and control variables respectively. The variables cover characteristics for both firm and individual executive level, and several accounting measures. A complete overview of the variables can be found in Appendix A1 and A2.

3.3.1 Dependent variables – Firm performance

Through our dependent variables we want to approximate firm performance. We have chosen two measures for this purpose, namely return on assets (ROA), and return on equity (ROE). ROA and ROE are two common measures for evaluating how effective the management team of a company is at utilizing its recourses (Berk & DeMarzo, 2014). In the following, we elaborate further on ROA and ROE separately, before we provide a closer look on what separates them from each other.

ROA measures the company's profitability relative to the book value of its total assets and is usually displayed as a percentage or ratio. The measure can be interpreted as a ratio of earnings generated to the total capital invested in the firm. It tells us something about how efficient the company is at utilizing its assets in order to generate earnings. A higher ROA signals more (earnings) for less (invested in assets). For our study, the ROA is computed by dividing a firm's net income by the total assets of the firm reported at the end of the given fiscal year. As profits for a firm can be negative, the ROA will in such a case also be negative.

As a comparative measure, ROA is commonly used amongst practitioners when comparing i) firms with same level of capitalization and characteristics or ii) benchmarking a company's current performance relative to their previous performance. ROA tends to vary significantly

across companies and is often substantially dependent on the industry in which it operates. Comparing ROA across industries can be problematic. Firms in the same industry tend to have a more similar characteristics and capitalization. The measure is widely used amongst investors as one of several ways of measuring how a company is performing compared to industry peers. Hence, a measure adjusting for this variation is necessary in order to conduct a reliable comparison of performance across industries for listed companies. Industry is used as a control variable in the empirical analysis to address this concern.

Assets are financed by (and equal to) leverage and equity. Hence, ROA implicitly takes into consideration the debt of a company and is less sensitive to leverage compared to ROE. ROE, on the other hand, does not consider debt and is therefore highly dependent on capital structure. The more debt a company has, the higher the ROE will be relative to the ROA. ROE indicates the profitability of a company relative to the equity invested in it by private and institutional investors. Computing the ROE follows the same pattern as the above-mentioned ROA. The difference is that the net income is divided by the value of the firm's equity instead of its assets.

3.3.2 Independent variables – Gender and executive diversity

Having collected data on gender, as well as other individual characteristics, for both individual CEOs and CFOs, it is possible to use data on a combined level for the two executives. This is utilized to generate a proxy for diversity at the firm level for the observations in our sample. In the following, we present the key independent variables of our study; Executive diversity, and CEO- and CFO gender.

The basis for the independent variables is the gender of the top executives in our sample. The gender was manually found as part of the data collection process by searching through information provided by ATEKST, company websites and filings. For the firms included in our final sample, we have found the name of the CEO/CFO for each of the relevant fiscal years and attributed the selected executive with a value for the gender variable (*gen_CEO* and *gen_CFO*). The gender variables are dummy variable, where a value of 1 indicates a female CEO/CFO. These are used standalone as independent variables, as well as a basis for forming the other independent variable used in the empirical analysis. For our sample, there were no noteworthy edge-cases of doubt related to connecting the names to a specific gender.

Executive gender composition (*exe_comp*) is generated by combining the above-mentioned gender variables. The combination ultimately provides a discrete variable with four possible outcomes; 1) CEO and CFO male, 2) CEO male and CFO female, 3) CEO female and CFO male, and 4) CEO and CFO female. We use diversity amongst the seated CEO and CFO of a firm at the end of a given accounting year as a proxy for gender diversity. The proxy (*exe_div*) is a dummy variable based on the executive composition. A composition including both genders generates the value 1 for the dummy, whereas a composition where only one gender is represented, generates a value of 0 for the diversity variable. Note the implications this has for firms with females (males) in both top executive positions; they are interpreted as non-diverse.

3.3.3 Control variables – Executive and firm characteristics

The control variables are divided into two main categories; firm level and executive level. At the firm level, we include the firm characteristics; firm size, firm age and the industry in which the firm operates in. The executive level control focus on individual characteristics of the CEOs and CFOs. The characteristics on the executive level and on the firm level provide us with a selection of control variables that will be used in the empirical analysis, and they are described in more detail below.

3.3.3.1 Firm-level characteristics

The industry variable is a dummy variable representing the 11 different industries. An overview of the industries is provided in Table 2 in Chapter 3.4. Companies with the legal form SPA[18] are not assigned to a specific industry in the SNF database. As the number of observations in our sample is relatively small, and a substantial amount of our observations (17.2 percent) are SPAs, we chose to define a new industry which we named "Savings banks".

The effect of firm size on profitability are mixed in the literature. Looking at 7,000 publicly held US companies, Lee (2009) found a positive correlation between firm size and

[18] SPA stands for "sparebank", in English "savings bank".

profitability. The observed effect was non-linear, with profitability[19] gains reducing with increased firm size. Prevalent reasons cited as underlying this effect are increased market power and efficiency gains (Lee, 2009). A positive effect was also found by Stierwald (2010). Becker-Blease, Kaen, Etebari, and Baumann (2010) find mixed results, and that the magnitude of the effect is dependent on the industry in which the firm operates. Studying publicly traded US companies between 1970-1989 Dhawan (2001) found a negative relationship between profitability and firm asset size. Niresh and Thirunavukkarasu (2014) had similar findings.

Firm size is also found to differ between female-led and male-led firms. Adams, Gupta, and Leeth (2009) analyzed US companies for the period 1992-2004 to test the glass cliff hypothesis and fond that firms appointing female CEOs tended to be smaller than those appointing male CEOs, when using four common measures of firm size, namely total assets, number of employees, sales and market value of equity (Adams, Gupta, & Leeth, 2009). We use the natural logarithm of the firms' total assets as a proxy for firm size, which is a commonly used proxy (Khana & Vieitob, 2013).

Firm age is generated by subtracting the year of incorporation from the relevant accounting year of each observation. Previous literature suggests that firm age has a negative impact on firm performance (Vafaei, Ahmed, & Mather, 2015; Conyon & He, 2017). Supporting research claims for younger firms to have a less formalized organizational structure, which in turn may lead to more efficient capitalization of the previously argued positive effects of gender diversity (Ali, Kulik, & Metz, 2011). The variable is used in a logarithmic scale in the empirical analysis.

3.3.3.2 Executive-level characteristics

For the executive-level characteristics, we include the age and education of the CEO and CFO as well as their tenure in their respective roles as control variables. Albeit showing mixed results, the literature suggest that they may impact firm performance, and hence can be of value to our empirical analysis. Below, we will look at the three in turn.

[19] Lee found this size-profit relationship to be robust with several alternative measures of profitability commonly used in other related studies, specifically; gross-profits-to-sales ratio, return on assets gross of advertising, pre-tax profit plus interest paid to total assets and return on assets.

Intuitively, one can assume that old executives have a competitive advantage relative to young executives who inevitably have less work- and real-life experience. Davis (1979) examined the validity of this assumption and found no significant connection between executive age and firm performance. Bertrand and Schoar (2003) argued for older executives to be more conservative, which in turn could yield both a positive and a negative impact on firm performance. Gibbons and Murphy (1992) suggested for older CEOs to be more likely to choose projects paying off quickly and before the event of retirement. Similarly, Hirshleifer (1993) argued that younger CEOs tend to have more focus on short-term goals, driven by the desire to build their reputation at an early stage of their career.

Executive tenure is widely discussed in the literature, and there is evidence of several studies reporting a positive correlation between executive tenure and firm performance. For instance, Baysinger and Hoskisson (1990) argued that experienced executives accumulate more firm-specific knowledge, which makes them more efficient in monitoring and providing valuable resources. In contrast, Ryan and Wiggins (2001) suggest that executives with extensive tenure may be in entrenched positions which enables them to pursue personal interests. This may potentially have a negative impact on firm performance. Huson, Malatesta and Parrino (2004) examines the relation between CEO turnover and firm financial performance. They argue that turnover announcements are associated with positive changes in accounting measures for firm performance. Further, they advocate a positive link between appointment of an external (rather than an internal) CEO, and accounting measures of performance relative to other firms.

Educational background may arguably serve as a proxy for intelligence. More intelligent managers may imply better managers. There are several studies which find that CEOs with higher educational attainment have a greater capacity to process information and innovate, relative to CEOs with lower educational attainment[20]. While the findings from these studies are not explicitly examining firm performance, they are implicitly arguing that higher education amongst CEOs is positively correlated to firm performance. For instance, they found evidence of more innovative companies being led by CEOs with higher educational attainment. Belliveau, O'Reilly and Wade (2017) argue that educated CEOs tend to have more social ties attained to other CEOs, decision makers and government officials through their

[20] Kimberly and Evansiko (1981), Bantel and Jackson (1989), Hitt and Tyler (1991), Thomas, Litschert and Ramaswamy, (1991), Wiersema and Bantel (1992), and Wally and Baum (1994) found that more educated CEOs are better at processing information and more receptive to change than CEOs with lower educational attainment.

enrolment as students, which in turn has a positive effect on firm performance. Graham and Harvey (2002) found that highly educated executives may be more likely to use sophisticated methodologies when estimating the cost of capital or when conducting capital budgeting. Further, they argue these sophisticated methods have a positive link on firm performance. Studying 14,500 CEO-years and 2,600 cases of CEO turnover for 1,500 of the largest U.S. companies from 1993-2007, Bhagat, Bolton, Brian and Subramanian (2010) do not find a systematic relationship between long-term firm performance and CEO education. They also argue that CEO education does not seem to be a good proxy for CEO ability.

3.4 Descriptive statistics

In this section, we present descriptive statistics of our sample. We will begin by looking at characteristics for the companies that are present in the sample. The structure follows a similar outline to that in Chapter 3.3, starting with the dependent- and independent variables before looking at the correlation between the two. The chapter will commence with a section with descriptive statistics for the control variables and briefly looking at other top executive characteristics in the sample.

3.4.1 Sample characterisitics

In the SNF database, the variable sector classifies the companies to have one of 10 different industry labels. Table 2 below shows how the observations in our sample are distributed between the industries[21]. In total, there are 11 industries present in the table, with the inclusion of a new category named Savings bank ("Sparebank" in Norwegian), created manually to separate out these entities. The Norwegian banking sector is characterized by a few large commercial banks, some regional- and several smaller savings banks[22]. The savings banks operate more active lending operations compared to most other countries, which is related to the commercial banks in Norway developing slower than the savings banks and has historically had a particularly strong presence as a source of funding in rural areas (Meinich, 2016). Shipping, alongside energy and seafood, are the three industries the Oslo Stock Exchange is most known for (Oslo Børs, n.d.). From Table 3.2, one can observe that the three largest industries are Offshore/Shipping, Manufacturing, and the aforementioned Savings banks as measured by the total number of observations in the sample period with 126, 119 and 112 observations respectively[23].

[21] For eight of the companies in the sample, the sector-value varied during the sample period. For these companies, the sector with most observations were chosen.

[22] In 2018, there were 99 sparebanker in Norway (Sparebankforeningen, n.d.), of which 20 have equity certificates listed on the Oslo Stock Exchange (Oslo Børs, n.d.).

[23] The companies within the Other services industry classification is a relatively broad group, with the following constituents: energy (28 observations), materials (14 observations), media (14 observations), healthcare (14 observations) and industrials (7 observations).

Table 3.2 - Observation count per industry

	Freq.	*% of total*	*Cum.*
Agriculture	28	4.30 %	4.30%
Offshore/Shipping	126	19.35 %	23.66%
Transport	14	2.15 %	25.81%
Manufacturing	119	18.28 %	44.09%
Telecom/IT/Tech	77	11.83 %	55.91%
Electricity	14	2.15 %	58.06%
Construction	28	4.30 %	62.37%
Wholesale/Retail	21	3.23 %	65.59%
Finance	35	5.38 %	70.97%
Other services	77	11.83 %	82.80%
Savings bank	112	17.20 %	100.00%
Total	*651*	*100.00 %*	

Summary statistics for the dependent variables are found in Table 3.3. The mean net income of the observations in the sample is 0.65, the mean equity value is 7.47 and the mean asset value is 21.26, all numbers in billion NOK. ROE and ROA are given as ratios, with a mean ROA of -8 percent and a mean ROE of -54 percent. The mean values are close to the 10^{th} percentile for both firm performance measures, indicating that the sample contains some outliers that skew the results. The minimum values for ROE and ROA are notably extreme.

Table 3.3 - Summary statistics for dependent variables

	Mean	*SD*	*P10*	*P50*	*P90*	*Min.*	*Max.*
Net income	0.65	5.26	-0.13	0.05	1.06	46.83	69.97
Equity	7.47	31.52	0.12	1.11	10.89	-0.98	358.17
Assets	21.30	73.46	0.32	3.60	44.41	0.00	825.57
ROA	-0.08	2.34	-0.09	0.01	0.16	-59.10	2.45
ROE	-0.54	15.64	-0.18	0.07	0.36	-398.13	7.88

3.4.2 Dependent variables

As our sample includes companies within industries with varied characteristics, some variables can be particularly meaningful to group by industry, including the dependent variables ROE and ROA.

In Table 3.4, summary statistics for ROE and ROA are shown for the sample across the different industries. When looking at an aggregate level, the mean ROE value is -54 percent. For ROE, the relatively large number of observations from the Offshore/Shipping sector, with a mean ROE of -14 percent and in particular, some observations with extreme values found in the Telecom/IT/Tech sector leading to a mean ROE of -512 percent, skew the results. For the other industries, mean ROE range between -7 percent for Other services and 57 percent for the Construction industry. For ROA, the mean value for the sample is -8 percent, with the Telecom/IT/Tech sector again having a significant negative impact on the total with a mean value of -72 percent. Looking at the other industries, the mean ROA range between -5 percent for Offshore/Shipping and 13 percent for the Construction industry.

Table 3.4: ROA and ROE per industry

		ROA					*ROE*				
	N	*Mean*	*SD*	*P50*	*Min.*	*Max.*	*Mean*	*SD*	*P50*	*Min.*	*Max.*
Agriculture	28	0.08	0.06	0.06	-0.02	0.21	0.14	0.15	0.09	-0.04	0.73
Offshore/Shipping	126	-0.05	0.41	0.00	-3.63	1.33	-0.14	2.01	0.00	-19.27	7.88
Transport	14	0.02	0.05	0.02	-0.05	0.16	0.03	0.16	0.07	-0.42	0.21
Manufacturing	119	0.03	0.16	0.03	-0.90	0.58	0.15	0.72	0.08	-2.01	6.39
Telecom/IT/Tech	77	-0.72	6.84	0.05	-59.10	2.45	-5.12	46.00	0.07	-398.13	4.05
Electricity	14	0.03	0.03	0.02	-0.02	0.10	0.06	0.07	0.05	-0.05	0.20
Construction	28	0.13	0.18	0.05	-0.12	0.57	0.57	0.93	0.25	-0.21	3.50
Wholesale/Retail	21	0.03	0.11	0.03	-0.35	0.24	0.06	0.20	0.05	-0.67	0.35
Finance	35	0.01	0.09	0.03	-0.34	0.11	0.06	0.18	0.03	-0.46	0.38
Other services	77	-0.03	0.54	0.02	-4.10	0.90	-0.07	0.83	0.02	-4.82	2.00
Savings bank	112	0.01	0.00	0.01	-0.01	0.02	0.09	0.03	0.09	-0.08	0.17
Total	*651*	*-0.08*	*2.34*	*0.01*	*-59.1*	*2.45*	*-0.54*	*15.64*	*0.07*	*-398.13*	*7.88*

In Table 3.5, we split the summary statistics for the dependent variables ROA and ROE by our key variables used in the empirical analysis. The most extreme negative and positive values for both ROA and ROE is found for male CEOs and CFOs.

Table 3.5 - Summary statistics of ROA and ROE with diversity indicators

	N	*P10*	*Mean*	*P90*	*SD*	*Min.*	*Max.*
ROA							
Diverse firms	110	-0.100	-0.044	0.093	0.456	-4.100	1.328
Non-diverse firms	541	-0.085	-0.086	0.163	2.555	-59.103	2.453
CEO Female	21	-0.051	0.097	0.173	0.312	-0.344	1.328
CEO Male	630	-0.091	-0.085	0.153	2.374	-59.103	2.453
CFO Female	93	-0.085	-0.073	0.058	0.469	-4.100	0.2075
CFO Male	558	-0.098	-0.080	0.167	2.517	-59.103	2.453
ROE							
Diverse firms	110	-0.130	-0.025	0.172	0.586	-4.817	2.378
Non-diverse firms	541	-0.187	-0.650	0.416	17.157	-398.125	7.877
CEO Female	21	-0.081	0.152	0.363	0.572	-0.811	2.378
CEO Male	630	-0.185	-0.568	0.368	15.900	-398.125	7.876
CFO Female	93	-0.120	-0.062	0.140	0.573	-4.817	0.329
CFO Male	558	-0.187	-0.625	0.416	16.894	-398.125	7.876

3.4.3 Independent variables

In this chapter, the sample characteristics of the key independent variables described in chapter 3.3.2 will be presented.

Figure 3.1 looks at the variables related to executive gender. Specifically, it illustrates the share of female CFOs and female CEOs as well as the total of the two measures for the sample period[24]. The y-axis shows the share of female CFOs and CEOs respectively. The difference between the two executive roles is notable, with the share of female CFOs observations ranging from 3.2 - 4.9 times higher than that of the female CEO observations during the sample period. On an aggregate level, there occurs a jump from 2010 to 2011 where the total share of female top executives increase from 12.9 percent to 17.2 percent. This figure remains relatively flat during the rest of the sample period, indicating that no significant increase in the total number of female top executive observations is found in the sample.

The percentage of female CEOs range between 2.2 percent (2010) and 4.3 percent (2016) in the sample period. For Norwegian public companies (ASA), the female CEO percentage for the same period ranged between 5.5 percent (2015) and 7.8 percent (2012) (Statistics Norway, n.d.)[25]. Figure B1 in the Appendix shows the distribution of CEO gender by industry.

Figure 3.2 shows the distribution of gender composition of the top executives in the sample period. In line with the observations made in Figure 3.1, the most common composition involving a female top executive is where the CEO is a male and the CFO is a female. In our sample, we only have two observations of firms with a female CEO and CFO.

[24] The figure leaves out the share of male CFOs and male CEOs, accounting for the remaining, and majority share for both groups. For the Total-figure, the percentage is out of an aggregate total of 200 percent, where the remaining percentage is the aggregate percentage of male CEOs and male CFOs.

[25] The percentage of female CEOs for the full period were; 6.5 percent (2010), 6.6 percent (2011), 7.8 percent (2012), 5.8 percent (2013), 6.4 percent (2014), 5.5 percent (2015), 7.2 percent (2016).

Figure 3.1 – Proportion of female CEOs and CFOs

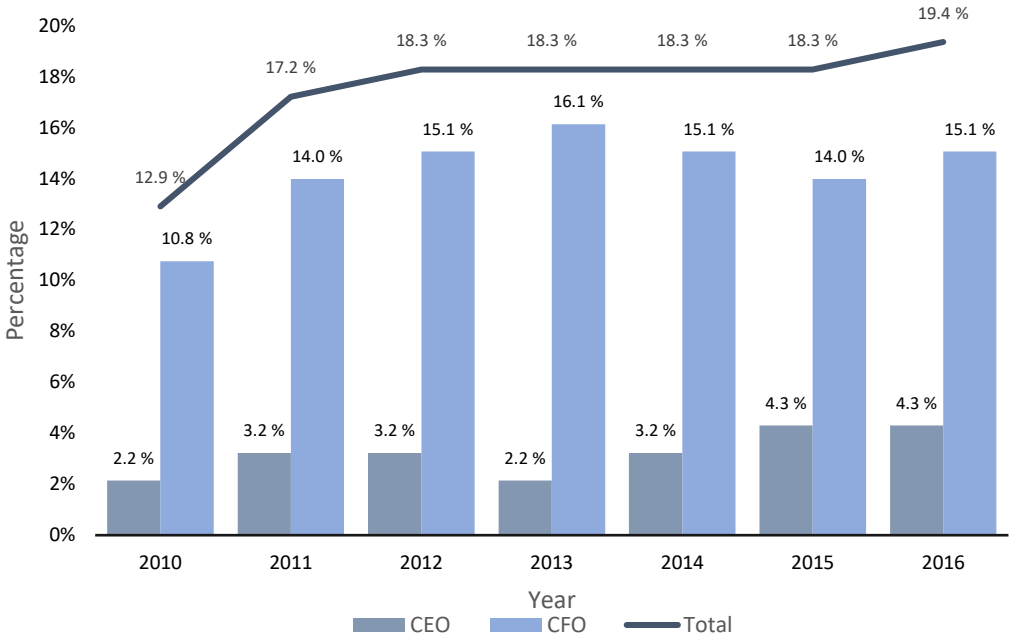
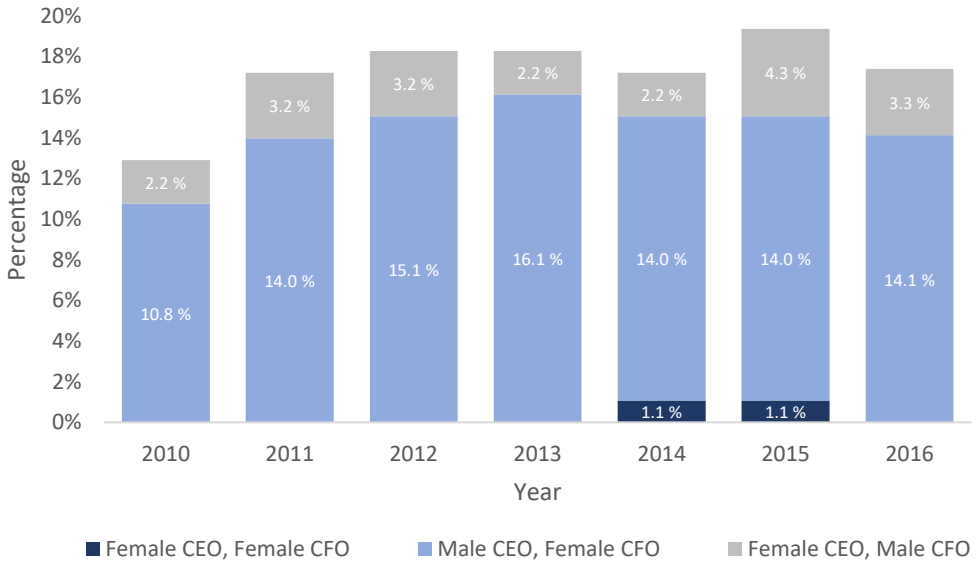
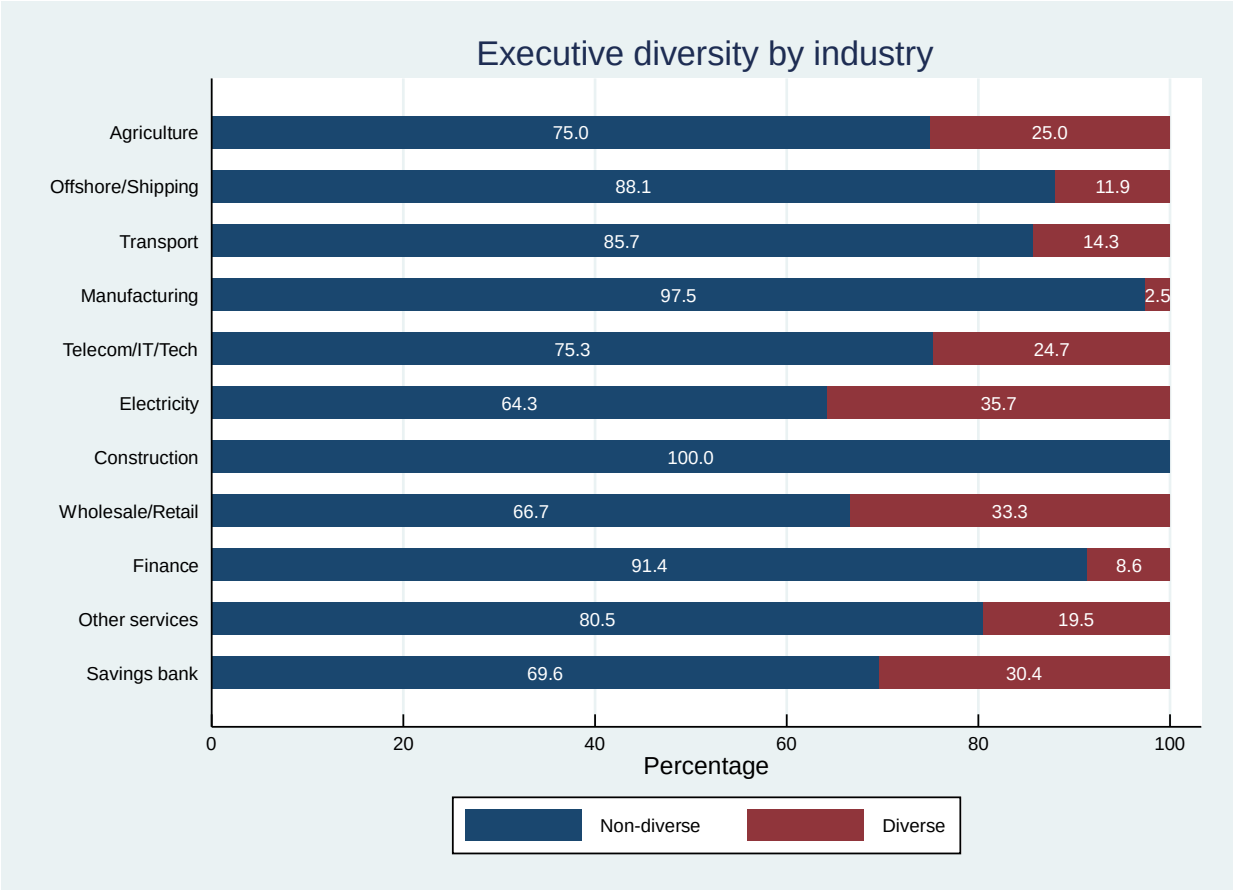


Figure 3.2 – Gender composition of top executives



Executive diversity by industry is displayed in Figure 3 below. The figure shows the percentage of observations that are characterized as diverse and non-diverse for the full sample. The percentage of non-diverse observations are in majority for all the industries. On one extreme end, the sample contains no observations within the construction industry with a combination of the two genders in the top executive roles in the sample. At the other end, we find several industries with a percentage of observations ranging between 20-36 percent, including Electricity (35.7 percent), Savings bank (30.4 percent), Wholesale/Retail (33.3 percent) and Telecom/IT/Tech (24.7 percent).

Figure 3.3 – Executive diversity by industry



3.4.4 Correlation between the dependent and independent variables

In figures 3.4 – 3.9 below, box plots are included to show the distribution of values for the dependent variables, ROA and ROA, split by the independent variables. The values of ROA and ROA are restricted to be between -1.25 and 1.25 to exclude some extreme values that reduce interpretability. The horizontal line within the boxes shows the median value, while the upper and lower hinge of the boxes indicate the 75^{th} and 25^{th} percentiles respectively. It is important to note that are significant differences in the number of observations between the various subcategories of the independent variables, notably that subcategories with male top executives have many more observations relative to those with female top executives. This emphasize the importance of being cautious when trying to draw conclusions.

In figures 3.5 and 3.8, we observe a positive median value for both female and male-led firms, with the distribution of observations of female-led firms on ROE having notably higher quartile values than that of male-led firms. Comparing diverse and non-diverse firms in figures 3.6 and 3.7, we observe similar distributions of quartile values, albeit observations of non-diverse firms have much more outside values as expected. Looking at CFO gender, the distribution of firm observations with a male CFO has a higher median and 75^{th} percentile than the observations with a female CFO, found in figures 3.4 and 3.9. This is observed for both the ROA and ROE plots.

In summary, there are slight indications that diverse firms are associated with having a lower ROA and ROE compared to non-diverse firms. The observations of female-led firms, however, have a higher median and 75^{th} percentile than their male-led counterparts. Observations of firms with a male CFO seem to be associated with a higher ROA and ROE than firms with a female CFO. Finally, it is important to note that are no plots in which the median value of a subcategory lie outside the box of another subcategory, which would indicate that a true difference between the distributions would be likely.

Figure 3.4 – ROA and CFO gender

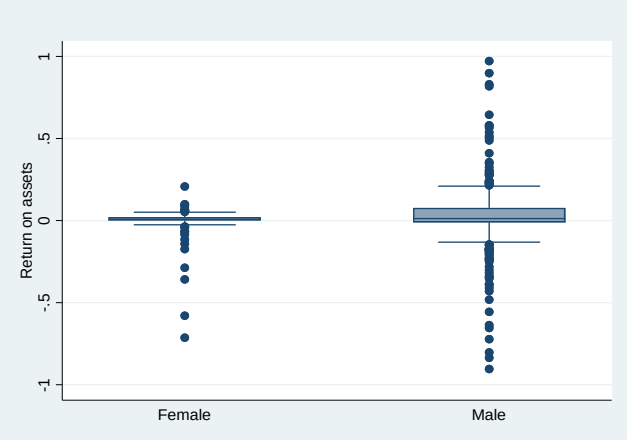


Figure 3.5 – ROA and CEO gender

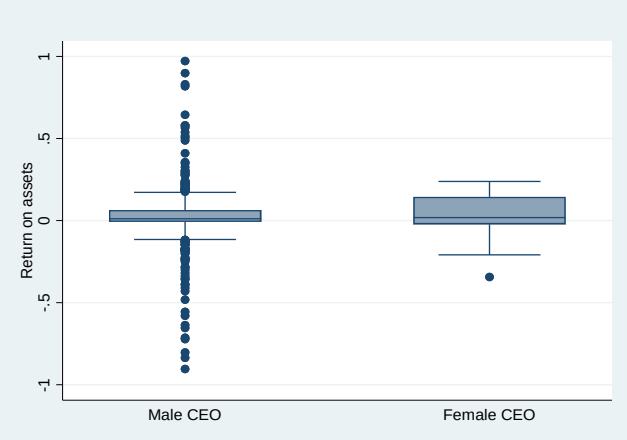


Figure 3.6 – ROA and executive diversity

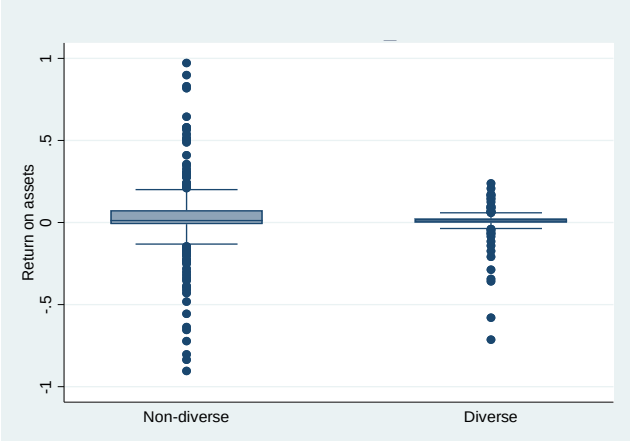


Figure 3.7 – ROE and executive diversity

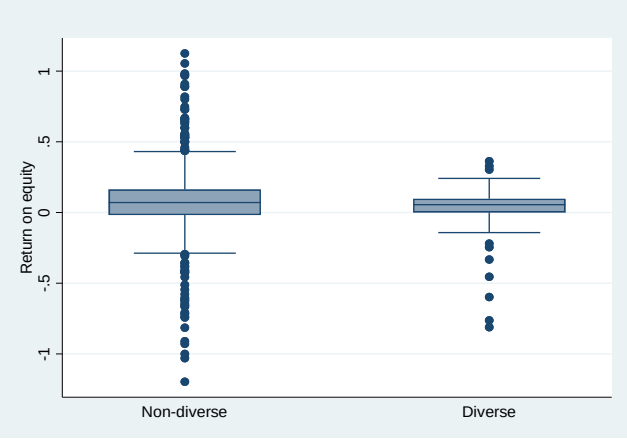


Figure 3.8 – ROE and CEO gender

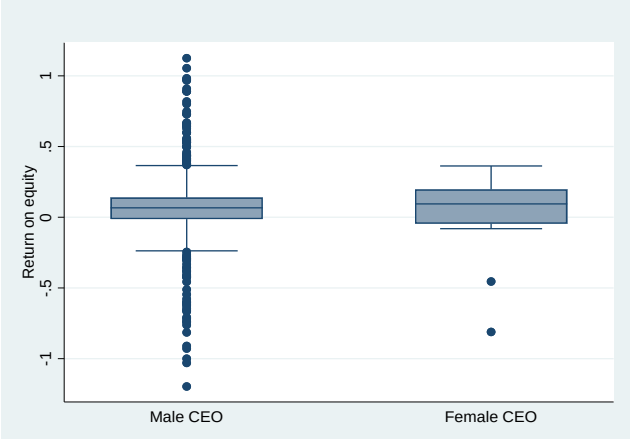
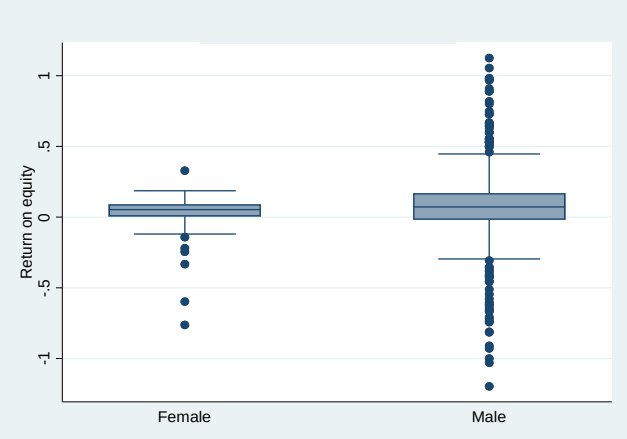


Figure 3.9 – ROE and CFO gender



3.4.5 Control variables

This section provides summary statistics for the executive level- and the firm level control variables.

Table 3.6 below includes the variables split by CEOs and CFOs as well as on an aggregate level for the full sample. Both the observed female CEOs (48.5 years) and female CFOs (45.8 years) are younger than their male counterparts on average, 51.5 years and 47.5 years respectively. The average tenure is relatively similar between the two genders for the CFOs in our sample (5.3 for females and 5.7 for males). For female CEOs however, the female observations have an average tenure of 2.7 years, while the same figure for male observations is 5.9.

Table 3.6: Top Executive characteristics by gender and role

	CEO						*CFO*					
	N	*Mean*	*SD*	*P50*	*Min.*	*Max.*	*N*	*Mean*	*SD*	*P50*	*Min.*	*Max.*
Whole sample												
Age	642	51.44	7.10	52.00	30.00	70.00	643	47.26	7.09	47.00	31.00	74.00
Tenure in firm	651	9.65	8.20	6.50	0.08	36.50	626	8.99	7.82	6.50	0.08	35.50
Tenure in role	651	5.81	5.27	4.50	0.08	31.50	610	5.64	5.06	4.17	0.08	27.50
Female												
Age	21	48.48	4.86	48.00	41.00	59.00	89	45.79	5.93	46.00	32.00	57.00
Tenure in firm	21	7.07	9.99	3.50	0.33	31.50	92	8.22	8.01	5.50	0.42	31.50
Tenure in role	21	2.66	2.15	2.25	0.25	7.33	92	5.26	4.54	4.33	0.08	20.50
Male												
Age	621	51.54	7.15	52.00	30.00	70.00	554	47.49	7.23	47.00	31.00	74.00
Tenure in firm	630	9.74	8.13	6.71	0.08	36.50	534	9.13	7.79	7.00	0.08	35.50
Tenure in role	630	5.92	5.31	4.50	0.08	31.50	518	5.71	5.15	4.08	0.08	27.50

Figure 3.10 (CEOs) and figure 3.11 (CFOs) shows the distribution of the educational level for the top executives in the sample. For female CEOs and CFOs, a majority have a master's degree, 57.1 percent and 68.2 percent of the total sample for the two groups respectively. When looking at their male counterparts, holding a master's degree is even more common, accounting for 76 percent and 83.2 percent for the male CEOs and male CFOs respectively. At the two edges of the spectrum, top executives without a university degree and those holding a PhD degree, we observe that both subgroups are solely found among male top executives. In our sample, 4.2 percent of the male CEOs had obtained a PhD degree (none of the male CFOs), while the share of top executives without a university degree only account for 0.3 percent of male CEOs and 0.6 percent of male CFOs.

Figure 3.10 – Education CEO

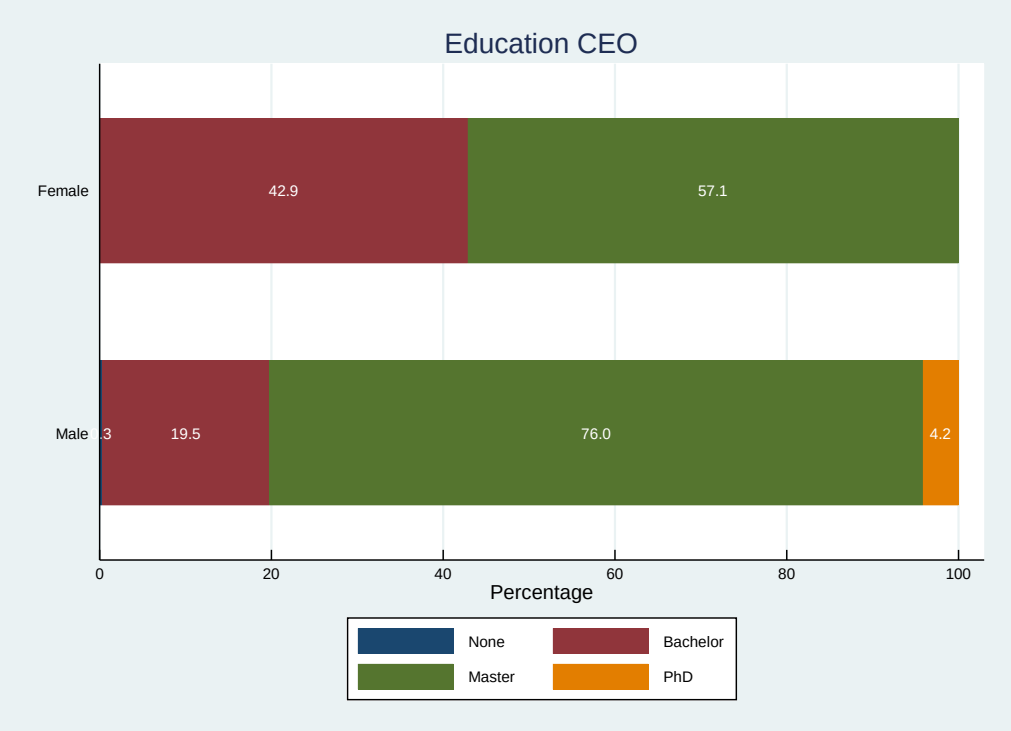
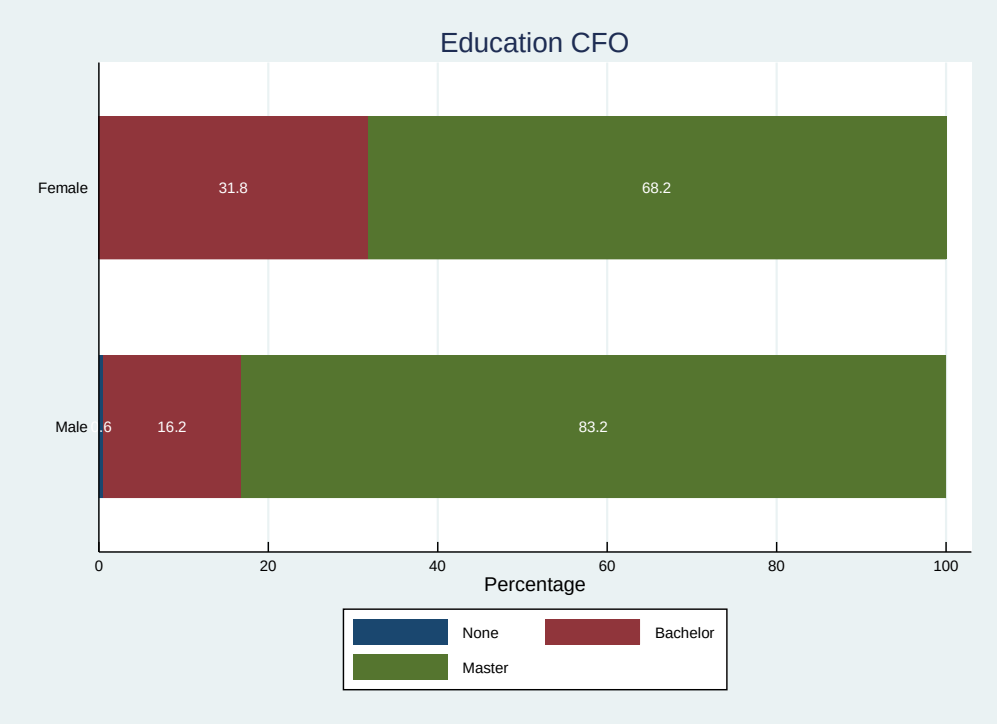


Figure 3.11 – Education CFO



Summary statistics for the control variables *Firm age* and *Firm size* is shown in tables 3.7 and 3.8 above. For firm age, the sample has a mean value of 47 years, while differences between the various industries are notable, ranging from an average of 18 years in the Telecom/IT/Tech industry to a firm age of 116 and 100 for the Electricity and Savings bank industries respectively. For firm size, the mean value is NOK 21.25 billion, with Wholesale/Retail having the lowest mean value of NOK 1.76 billion and Offshore/Shipping having the highest value with NOK 40.46 billion.

Table 3.7 - Firm age by industry

	N	*Mean*	*SD*	*P50*	*Min.*	*Max.*
Agriculture	30	24	5.7	23.0	15	35
Offshore/Shipping	129	27.3	23.0	15.0	3	81
Transport	14	76.5	58.7	76.5	17	136
Manufacturing	115	40.6	36.3	27.0	7	143
Telecom/IT/Tech	75	18.1	6.3	17.0	7	32
Electricity	14	116	2.3	116.0	112	120
Construction	28	42	26.8	41.5	5	80
Wholesale/Retail	26	49	31.5	46.0	10	91
Finance	29	42.6	62.7	13.0	5	169
Other services	79	34.6	32.3	18.0	2	112
Savings bank	112	100	67.0	90.5	21	193
Total	*651*	*47*	*49.0*	*26.0*	*2*	*193*

Table 3.8 - Firm size by industry

	N	*Mean*	*SD*	*Min.*	*Max.*
Agriculture	30	10,750.67	11,200.59	2,005.93	36,373.00
Offshore/Shipping	129	40,456.27	153,722.50	101.68	825,574.00
Transport	14	8,436.92	9,922.29	436.84	29,607.82
Manufacturing	115	15,393.76	25,658.30	94.96	96,010.00
Telecom/IT/Tech	75	12,998.30	38,905.46	0.49	146,322.00
Electricity	14	11,744.33	7,946.27	3,966.40	23,642.00
Construction	28	7,752.03	6,417.45	723	21,570.48
Wholesale/Retail	26	1,764.52	1,802.43	310.96	5617.00
Finance	29	26,094.16	32,465.77	216.00	92,107.00
Other services	79	4,706.95	7,622.65	38.82	27,639.00
Savings bank	112	34,623.63	34,518.07	3,174.07	136,061.00
Total	*651*	*21,257.19*	*73,461.56*	*0.49*	*825,574.00*

Firm size is measured by total assets and given in million Norwegian kroner

There is one group of variables that fall outside of the three main categories presented in chapters 3.4.1 through 3.4.3 that gives additional insights into our sample, and that therefore is presented below. This is the set of variables characterizing the type of change that occurred when a CFO or CEO were replaced in the sample period.

Table 3.7 shows the frequency of the various types of executive-level changes that occurred for the companies in the sample period. For both CEOs and CFOs, the most common change was from a male executive to a new male executive, accounting for 75 percent and 92 percent of the changes respectively. From Table 3.6, one can observe that the average tenure of a female CFO was 5.26 years, versus 2.66 for female CEOs, which helps to explain the relatively few CFO changes that include a woman in Table 3.7, taking into consideration that there are more female CFO observations than female CEOs observations in the sample.

Table 3.9: Top Executive changes

	CEO			*CFO*		
	Freq.	*% of tot*	*Cum.*	*Freq.*	*% of tot*	*Cum.*
Male to Male	65	75	75	88	92	92
Male to Female	9	10	85	5	5	97
Female to Male	10	11	97	3	3	100
Female to Female	3	3	100	0	0	0
Total	*87*	*100*		*96*	*100*	

4. Methodology

This chapter presents the methodological approach applied in our empirical analysis.

4.1 Multiple regression

Multiple regression is frequently used for empirical analysis in economics and other social sciences. Multiple regression helps generalizing the relationship between a set of variables. When estimating the parameters of a multiple regression model, the method of ordinary least squares (OLS) is widely used amongst practitioners (Woolridge J. , 2018, p. 96). In contrast to simple regression, where we only have one explanatory variable, multiple regression includes several explanatory variables. Thus, multiple regression may provide a more nuanced explanation of the gender-performance relationship, by explicitly controlling for factors that simultaneously may affect firm performance. In other words, we can make ceteris paribus interpretations of the estimated coefficients. In our study, this means that we can infer what partial effect our key variables have on firm performance. In a simple regression, additional explanatory variables are allocated in the error term. For instance, if we include gender as the only explanatory variable in a regression, we would have to assume that other factors like tenure and firm size are uncorrelated with firm performance for the regression to yield unbiased estimates, which is a tenuous assumption.

4.1.1 Assumptions for unbiased estimates

OLS is based on five core assumptions (Kennedy, 2008, pp. 41-42). First, the dependent variable must be formulated as a linear function of a set of independent variables and an error term. Second, the error term must be exogenous, meaning it has an expected value of zero, and is not correlated with any of the other regressors. Third, the error terms must have the same variance (*homoskedasticity*), and they cannot be correlated with any of the independent variables (*autocorrelation*). Fourth, observations of the independent variable are not stochastic but fixed in repeated samples without errors in measurement. Fifth and finally, there is no *multicollinearity* (no exact relationship amongst the independent variables).

If the assumptions hold, for any value of the population parameters, β_i, the OLS estimators are unbiased estimators of the population parameters.

4.1.2 Pooled ordinary least squares

The pooled OLS regression model gathers all observations in a given dataset, and pools them together when trying to fit a regression model. In practice, this implies ignoring the panel structure of the data. All observations are treated as independent from one another (Wooldridge, 2016, pp. 402-426). The model generates a constant intercept and slope coefficient(s) where the aspect of time and grouping is ignored. Specifically, the pooled OLS suggests for observations of a firm in one year to be independent of an observation of the same firm in any other year. Assuming there are no individual effects (u_i) attributed to either time or cross-section ($u_i = 0$), pooled OLS produces efficient and consistent parameter estimates. If, however, there are such individual effects present, and if they remain constant through time, the pooled OLS becomes subject to serial correlation, and will hence generate biased estimates.[26] This complication will be addressed in the next section, where we introduce panel data methods which allows for the error term and the explanatory variables to be correlated.

4.1.3 Fixed effects

Panel data methods provide ways to account for heterogeneity within the cross-sectional entities (firms in our case). When using panel data methods, one overarching decision must be made between using a fixed effects model and a random effects model. In the fixed effects approach, we assume α_i is correlated with the explanatory variables. In a random effects approach, we assume the opposite - that α_i is uncorrelated with the explanatory variables.[28] Both approaches assume for their respective views of the correlation to hold true for all periods *t*. Because the fixed effect estimation allows for arbitrary correlation between α_i and the explanatory variables, it is widely thought of as a more convincing tool for estimating ceteris paribus effects.

[26] The resulting bias in pooled OLS is sometimes referred to as *heterogeneity bias*, but it is really just bias caused from omitting a time-constant variable.
[28] According to Woolridge (2012), situations in which there is no correlation between the unobserved firm effect and the explanatory variables should be considered as an exception rather than the rule.

A motivation for using panel data is to allow the unobserved firm specific effects, α_i, to be correlated with the explanatory variables (Woolridge J. M., 2012, p. 493). A traditional view of the fixed effects approach is to assume an unobserved effect to be an estimated parameter for each firm. For econometric analysis of panel data, we cannot assume for observations to be independently distributed across time. For instance, unobserved and time-constant factors (e.g. culture) that affect a firm's performance in one year will likely also affect the performance of that firm the next year. The fixed effect transformation simply removes such time-constant and unobserved attributes of the firms in the sample. Under a strict exogeneity assumption on the explanatory variables, the fixed effect estimator is unbiased. The fixed effect model is

$$\text{(I)} \qquad y_{it} = \beta_1 x_{it1} + \beta_2 x_{it2} + \cdots + \beta_k x_{itk} + a_i + u_{it}, \quad t = 1, 2, \dots, T$$

Equation I uses time-demeaning on each of the explanatory variables and then does a pooled OLS regression using all the time-demeaned variables. The idiosyncratic error term, u_{it}, must be uncorrelated with each explanatory variable across all time periods for the OLS to produce estimates with unbiased coefficients. The fixed effects transformation is also called the within transformation[31]. The within estimator can be interpreted as a pooled OLS estimator which is biased on the time-demeaned variable. The within transformation uses deviations from group means when estimating the parameters. The unobserved effect, a_i, is eliminated by demeaning the variable in the within transformation.

The equivalent of using a fixed effect transformation is to add a dummy for each of the firms to the regression. A drawback of the transformation is that time-constant observable factors, such as for instance industry, are swept out of the regression in the data transformation process. Time-constant variables cannot be included by themselves in a fixed effects regression. Nevertheless, they can be interacted with variables that change over time, and, in particular, with year dummy variables. By adding year dummies to the regression, we can see how different measures of firm performance vary across time. However, we cannot use the transformation to estimate firm performance in the base year, which implies we cannot estimate firm performance for any year. What we *can* do is comparing how the firm

[31] The naming comes from the fact that the OLS estimator uses time variation in firm performance and the explanatory variables within each cross-sectional observation (Woolridge J. , 2018, p. 463).

performance in a specific year may differ from the base year.

4.1.4 Biased estimation

Omitting an important factor that is correlated with any of the independent variables causes for assumption 2 stated in chapter 4.1.1 to be violated. Practitioners refer to this phenomenon as *omitted variable bias*. In the case of explaining the variation in firm performance, failure to control for all relevant factors can cause systematic bias in estimating discrepancies due to the omitted variable bias. Panel data estimators such as the fixed effects transformation allows for us to consistently estimate the effect of the observed explanatory variables if their impact on firm performance remains constant through time. Nevertheless, in any application, there are always factors that, due to data limitations or measurement issues, will be impossible to include in the regression models. The choice of whether to include a particular variable in a regression model can be made by analyzing the trade-off between bias and variance. If an explanatory variable does not have a partial effect on firm performance, then including that variable in the regression can exacerbate a multicollinearity problem which leads to less efficient estimators. A higher variance in the estimated coefficients is the cost of including an irrelevant variable in the model.

Increasing specifications of a model leads to a more complex model with more numerator[34] degrees of freedom. When we conduct hypothesis testing, the numerator degrees of freedom are the number of regression parameters that uniquely define the hypothesis. It is the number of restrictions on the parameters. For some cases, degrees of freedom may be good for statistical power. Increasing the numerator degrees of freedom is *good* if the model gets a better fit so that the added parameters explain more of the variation in the dependent variable. Further, it is a *bad* thing if the added parameters do not explain enough of the extra variation in the dependent variable to account for the fact that the critical value for a test statistic becomes more stringent as the numerator degrees of freedom increases. The weakness of supplementing explanatory variables in a model arises when the sample data is limited in number of observations. The result is increased variance in the regression coefficients. Thus,

[34] The terminology comes from what is in the numerator of an F-test. The degrees of freedom in the numerator is the number of free regression parameters.

it decreases statistical power and we might achieve better power with a more parsimonious model.

Not surprisingly, it can be challenging to estimate the effect of any particular characteristic on firm performance when there is little variation in one variable that cannot be largely explained by variations in other characteristics. Such multicollinearity problems can be mitigated by collecting more data. However, as a result of the nature of our sample, we may potentially face one of many problems[35] of a small sample size. We may be asking questions that are too subtle for the available data to answer with precision.

4.2 Regression models

In the following section, we explain the regression models used in the empirical analysis. First, we explain the core structure of the models. Second, we explain the development of the seven regression models applied in the analysis. The seven regression models follow a stepwise approach, meaning we start with a simple model, and in turn add controls variables to the regression for each model, evaluating the impact on the parameter estimates for the explanatory variables of interest.

4.2.1 Structure of the regression models

The core regression model used for the empirical analysis is estimated by pooled ordinary least squares, and can be written as follows:

$$\text{(II)} \qquad Firm\ performance_{i,t} = \beta_0 + \beta_1 DIV_{i,j,t} + \beta_k \chi_{\mathrm{i,t,k}} + \nu_{i,j,t}$$

$$\nu_{i,j,t} = \alpha_i + \upsilon_{i,j,t}$$

$Firm\ performance_{i,t}$ displays the return on assets (ROA), or the return on equity (ROE) for a given firm *i*, in a given period *t*. The diversity indicator, $DIV_{i,j,t}$, covers the key explanatory variables - *Executive Diversity, and Gender CEO/CFO*. β_1 is the coefficient representing the estimated difference in firm performance caused by the gender diversity indicator(s) having

[35] See for example Goldberger (1991) on micronumerosity.

the value of 1 (otherwise 0). $\chi_{i,t,k}$ is a vector representing the *k* control variables which cover the logarithmic scale of i) a firms size and age, and ii) an executives tenure and age. Further, the vector also covers education of the executives and industry in which the firm operates in.

$u_{i,j,t}$ is the composite error term. α_i represents time-invariant and firm specific factors, whereas $v_{i,t}$ displays the unobservable *time varying* factors (idiosyncratic error). The subscript *j* indicates the individual top executives within a specific firm. Specifically, each firm has two values of $j \in \{CEO, CFO\}$ for each time period, *t*, the individuals holding the CEO and the CFO positions for that period. The error term also contains all other factors (not attributed to the CEO, CFO or firm), which is a source of variation in firm performance, often denoted ε.

4.2.2 Stepwise developement of regression models

This section describes seven different regression models. The initial model starts by using a simple linear regression. By using a stepwise approach, the following regression models add a controls for the firm (*age, size, industry*) and executive (*age, tenure, education).* In the last two regression models, we use the *within estimator* which allows us to control for the unobserved firm fixed effects.

Regression model 1: with diversity indicator

(1) $Firm\ performance_{i,t} = \beta_0 + \beta_1 DIV_{i,t} + \alpha_i + u_{it}$

The first regression model is a simple pooled OLS estimating the relationship between firm performance (*ROA and ROE*), and the gender diversity indicators (*DIV*) for a firm *i* in a year *t*. The diversity indicator covers the key explanatory variables - *Executive Diversity*, and *Gender CEO/CFO*. β_1 is the coefficient representing the change in firm performance caused by the gender diversity indicator(s) having the value of 1 (otherwise 0). α_i captures the time-invariant and unobserved firm fixed effect. u_{it} is the composite error term.

Regression model 2: with firm size and age controls

(2) $Firm\ performance_{i,t} = \beta_0 + \beta_1 DIV_{i,t} + \beta_2 Firm\ Size_{i,t} + \beta_3 Firm\ Age_{i,t} + \alpha_i + u_{i,t}$

In the second regression model, we add two firm controls: firm size and firm age. Thus, we here have a multiple regression model. The firm controls are measured in a logarithmic scale, meaning we interpret their respective coefficients, β_2 and β_3, as the absolute change in firm performance given a 1 percentage increase in the size/age of a firm *i* in year *t.*

Regression model 3: with industry dummies

$$(3)\ Firm\ performance_{i,t} = \beta_0 + \beta_1 DIV_{i,t} + \beta_2 Firm\ Size_{i,t} + \beta_3 Firm\ Age_{i,t} + \delta_s Industry_{i,s} + \alpha_i + u_{i,t}$$

The third model supplements regression model 2 by adding dummies for each industry subgroup *s*. Each firm, *i*, remains assigned to a specific industry consistent through time. There are 11 unique industries to which the firms can be allocated in the model. δ_s represents the coefficient for a particular industry relative to the base group (which is agriculture). If a firm *i* belongs in a given industry, $Industry_{i,s}$ gets the value 1. Thus, δ_s represents the expected change in firm performance for a firm belonging in an industry relative to a ceteris paribus firm in the base industry.[38]

Regression model 4: with annual trend

$$(4)\ Firm\ performance_{i,t} = \beta_0 + \beta_1 DIV_{i,t} + \beta_2 Firm\ Size_{i,t} + \beta_3 Firm\ Age_{i,t} + \delta_s Industry_{i,s} + \beta_4 Year + \alpha_i + u_{i,t}$$

This extended multiple regression model has a trend added to the equation. β_4 is the expected average increase in firm performance for each year. Thus, the coefficient also represents a trend for the period in which the data is observed (2010-2016). An alternative approach for incorporating a time trend is by adding dummy variables for each of the years. We use this approach in model 7 to study the short-term trends for each year.

Regression model 5: with executive controls

$$(5)\ Firm\ performance_{i,t} = \beta_0 + \beta_1 DIV_{i,t} + \beta_2 Firm\ Size_{i,t} + \beta_3 Firm\ Age_{i,t}$$

[38] An important note is that men and women are differently distributed across industries (See e.g. table Appendix B), and parts of that effect can be captured by controlling for industry effects.

$$+\delta_s Industry_{i,s} + \beta_4 Year + \beta_5 Tenure_{j,t} + \beta_6 Age_{j,t} + \gamma_k Education_{j,k} + \alpha_i + u_{i,j,t}$$

In regression model 5, we add three individual controls (*Tenure, Age, and Education)* for the top executives (*CEO and CFO*) of the firm. The *j*-index represents executive roles where $j \in \{CEO, CFO\}$. Tenure and age are computed in a logarithmic scale. Hence, a 1 percent increase in tenure (age) of an executive, *j*, in a firm, *i*, yields a β_5 (β_6) absolute change in firm performance. Level of education is indexed by $k \in \{None, Bachelor, Master, PhD\}$. Thus, γ_k represents the estimated change in firm performance when an executive, *j*, in a firm, *i*, has a *k* level of education at time, *t.*

Regression model 6: within estimator

$$(6)\ Firm\ performance_{i,t} = \beta_0 + \beta_1 DIV_{i,t} + \beta_2 Firm\ Size_{i,t} + \beta_3 Firm\ Age_{i,t} + \beta_5 Tenure_{j,t} + \beta_6 Age_{j,t} + \gamma_k Education_{j,k} + u_{i,j,t}$$

Regression model 6 is the result of a fixed effect transformation, where the model uses the within estimator. Notice that the unobserved firm heterogeneity, α_i, is removed from the equation. Since the industry dummy included in the previous models exhibits a fixed characteristic attributed to each individual firm, this variable is also wiped out in this model.

Regression model 7: within estimator and year dummies

$$(7)\ Firm\ performance_{i,t} = \beta_0 + \beta_1 DIV_{i,t} + \beta_2 Firm\ Size_{i,t} + \beta_3 Firm\ Age_{i,t} + \tau_t Year_{c,t} + \beta_5 Tenure_{j,t} + \beta_6 Age_{j,t} + \gamma_k Education_{j,k} + u_{i,j,t}$$

The final regression model builds on model 6, with additional year dummy variables included. The model includes a vector, $Year_{c,t}$, representing a dummy for each year $c \in \{2010, 2011, \ldots, 2016\}$. The base year is 2010, and is hence omitted. If c = t, the dummy equals 1 (otherwise 0). τ_t is the coefficient estimate for year, *c,* and captures the short-term trend (change) in firm performance for a specific year relative to that of the base year.

5. Results

This chapter provides a presentation of our findings from the empirical analysis. First, we present the results from our initial regression models. Second, we examine results from robustness checks to evaluate the sensitivity of our results.

5.1 Initial regression results

The regression results are presented in tables 5.1-5.2, with *executive diversity*, *CEO gender* and *CFO gender* as the key explanatory variables. The tables display the results from the seven regression models described in chapter 4. The results show how the key variables affect firm performance, measured by ROA and ROE, through a stepwise approach that gradually includes control variables on the firm- and individual executive level. Specifically, the tables are constructed in the following manner; column (1) and (8) shows the results for regression model 1, column (2) and (9) for regression model 2 and so forth. Columns (1) through (7) provides coefficient estimates with ROA as the independent variable, whereas columns (8) through (14) provide coefficient estimates for ROE. Due to some missing values for executive level characteristics, the number of observations is lower for the regression models that includes control variables for such characteristics.

5.1.1 Executive diversity

In this section, we present the results of the regression analysis investigating the relationship between the key variable, top executive gender diversity, and firm performance. The results are shown in Table 5.1. In column (1), firms with top executive gender diversity are, on average, associated with a 4.26 percentage point higher ROA than the firms without top executive gender diversity. In column (8), top executive gender diversity is, on average, associated with a 62.5 percentage point higher ROE compared to firms without top executive gender diversity. The coefficients are, however, non-significant.

After controlling for size and age of the firms in model 2, the coefficients increase in magnitude for both ROA and ROE compared to model 1. Controlling for industry and adding a year trend in models 3 and 4, further increase the magnitude of the coefficients. When

executive level control variables are added in model 5, the coefficients change sign, suggesting a negative relationship between executive diversity and firm performance. For the fixed effects regression models (models 6 and 7), we note that when using ROA as the dependent variable, the coefficients of executive diversity have a positive sign, while the opposite is the case when using ROE. The addition of dummy variables for fiscal year in model 7 has only a minor effect on the coefficient estimates for the key variable compared to model 6.

Overall, the coefficients vary in terms of magnitude and direction across the seven different models, with the parameter estimates being considerably larger in absolute magnitude for most of the regression models using ROE as the firm performance metric. The *executive diversity* coefficients are, however, non-significant for all the seven models. Thus, the regression results do not suggest there is a relationship between top executive gender diversity and firm performance

Table 5.1: Regression models with executive diversity as the key variable

	ROA							ROE						
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
Executive diversity	0.0426	0.204	0.31	0.314	-0.0625	0.0313	0.035	0.625	1.699	2.437	2.458	-0.0485	-0.0722	-0.0793
	(0.25)	(0.25)	(0.26)	(0.26)	(0.04)	(0.07)	(0.07)	(1.64)	(1.65)	(1.72)	(1.72)	(0.13)	(0.26)	(0.26)
Log (Firm age)		-0.0639	-0.0072	0.00161	-0.0093	-0.0269	0.0816		-0.447	-0.0702	-0.0143	-0.0264	-0.136	-0.422
		(0.10)	(0.12)	(0.12)	(0.02)	(0.09)	(0.14)		(0.67)	(0.77)	(0.78)	(0.06)	(0.33)	(0.52)
Log (Assets)		0.227***	0.262***	0.263***	0.00712	0.0448	0.0506		1.501***	1.708***	1.713***	0.0196	-0.214*	-0.242*
		(0.05)	(0.06)	(0.06)	(0.01)	(0.04)	(0.04)		(0.32)	(0.38)	(0.38)	(0.03)	(0.13)	(0.13)
Year (trend)				-0.0301	0.00192						-0.192	0.0108		
				(0.05)	(0.01)						(0.31)	(0.02)		
Log (CFO tenure)					0.0259**	-0.0026	-0.0021					0.0522	0.0394	0.0394
					(0.01)	(0.02)	(0.02)					(0.04)	(0.06)	(0.06)
Log (CEO tenure)					0.00679	-0.0004	-0.0007					0.05	0.0465	0.0494
					(0.01)	(0.01)	(0.01)					(0.04)	(0.05)	(0.05)
Log (CFO age)					0.0543	0.432**	0.437**					0.191	1.260**	1.211*
					(0.11)	(0.18)	(0.18)					(0.35)	(0.64)	(0.64)
Log (CEO age)					-0.0867	-0.218	-0.204					-0.657*	-1.228**	-1.248**
					(0.11)	(0.16)	(0.16)					(0.38)	(0.58)	(0.59)
Education CEO														
Bachelor					-0.118	-0.18	-0.153					-2.284***	-2.768***	-2.855***
					(0.23)	(0.24)	(0.25)					(0.77)	(0.88)	(0.89)
Master					-0.0604	-0.0529	-0.0339					-2.081***	-2.540***	-2.581***
					(0.23)	(0.25)	(0.25)					(0.76)	(0.89)	(0.90)
PhD					-0.0508	-0.159	-0.145					-1.916**	-2.680***	-2.744***
					(0.24)	(0.27)	(0.27)					(0.80)	(0.97)	(0.98)
Education CFO														
Bachelor					-0.0539	0.225	0.259					-0.222	1.046	0.899
					(0.19)	(0.24)	(0.24)					(0.64)	(0.85)	(0.86)
Master					-0.0363	0.255	0.291					-0.22	0.787	0.639
					(0.19)	(0.23)	(0.24)					(0.64)	(0.84)	(0.85)
Year dummies	No	No	No	No	No	No	Yes	No	No	No	No	No	No	Yes
Industry dummies	No	No	Yes	Yes	Yes	No	No	No	No	Yes	Yes	Yes	No	No
Constant	-0.0863	-3.314***	-4.101***	-4.017***	0.205	-1.537	-2.081*	-0.65	-21.89***	-27.12***	-26.59***	3.921*	5.404	7.254
	(0.10)	(0.71)	(1.03)	(1.04)	(0.64)	(1.08)	(1.24)	(0.67)	(4.74)	(6.90)	(6.95)	(2.15)	(3.90)	(4.47)
N	651	651	651	651	577	577	577	651	651	651	651	577	577	577
R^2	0	0.0341	0.0429	0.0435	0.0642	0.0342	0.0424	0.0002	0.0333	0.0428	0.0433	0.0681	0.0605	0.072

* p < 0.10, ** p < 0.05, *** p < 0.01. Standard errors in parentheses. For Executive diversity, the base group is "Non-diverse".

For CEO and CFO education, the base group is "None". Dummy variables for Industry and Year are not included in the table.

5.1.2 Female top executives and firm performance

In the following, we present the results of the regression analysis investigating the relationship between female top executive and firm performance. *CEO gender* and *CFO gender* are the key variables of interest for analyzing this relationship. The coefficients of these variables represent how firms with female CEOs/CFOs perform, on average, relative to firms with male CEOs/CFOs. The results are displayed in Table 5.2. We start the analysis by applying equation 1 without the control variables to investigate the relationship between the key variables and firm performance. The results are reported in columns (1) and (8). The results show that female CEOs and CFOs have a positive effect on both ROA and ROE, but that the effect is not statistically significant. Female CEOs are associated with an 18.2 percentage point higher ROA, and a 74.7 percentage point higher ROE, on average, relative to that of male CEOs. Female CFOs are associated with a 0.8 percentage point higher ROA, and a 57.2 percentage point higher ROE, on average, relative to that of male CFOs.

In model 2, displayed in columns (2) and (9), we control for firm characteristics (firm size and firm age). The magnitude of the executive gender coefficients increases notably for both ROA and ROE. Still, the coefficients are non-significant. In model 3 we control for industry effects. While the magnitude of the coefficients increases slightly, they remain non-significant. When adding a time trend in model 4, we only get a minor increase in the magnitude of the coefficients.

When adding executive controls in model 5, the CFO gender coefficient (with ROA as dependent variable, displayed in column (5)) becomes statistically significant at the .01 level. Further, the coefficient now becomes negative, where firms with female CFOs are associated with a 10.7 percentage point lower firm performance compared to that of firms with male CFOs on average. The coefficient also becomes negative for ROE, though non-significant. The CEO gender coefficient remains non-significant for both ROA and ROE, but the magnitude of the coefficient decreases notably. Not surprisingly, characteristics such as education, tenure and age seem to wipe out some of the gender effects on firm performance.

In model 6 we control for unobserved firm effects by running a fixed effects regression. The magnitude of the coefficient for CEO gender becomes significant at the .10 level when using ROA as the dependent variable. Firms with female CEOs are associated with a 20 percentage point higher ROA relative to that of firms with male CEOs on average. The coefficient

estimate is positive when using ROE as dependent variable, though non-significant. Further, the CFO gender coefficient becomes non-significant for ROA and remains negative. The magnitude of the coefficient also decreases. For ROE, the CFO gender coefficient also remains negative, but increases in magnitude. Model 7 adds year dummies to the fixed effects regression. The CEO gender coefficient remains at the same level of significance when using ROA as dependent variable, with a slight increase in magnitude of the coefficient. Further, there are minor, though non-significant, changes in the coefficient of the remaining key variables.

In addition, the same regression models displayed in Table 5.2 were run for each of the two executive roles separately. The results are displayed in tables 5.3 and 5.4. In table 5.3, when excluding CFO characteristics, we find similar results of the CEO gender effect as displayed in Table 5.2. However, the CEO gender coefficient is now significant at the .10 level in model 5, where a female CEO is associated with a 11.8 percentage point higher ROA. Furthermore, the coefficient estimates in model 6 and 7 increase slightly in magnitude, are significant at the .05 level.

Table 5.4 displays the results of the regression analysis investigating the relationship between CFO gender and firm performance (without controlling for CEO characteristics). The results are similar to that of regression results in Table 5.2. Models 1 through 4 display roughly the same magnitude for the coefficients. However, model 5 is now non-significant for ROA, and the coefficient increases in magnitude. As for ROE, the coefficient becomes positive, and the magnitude increases notably. The results suggest that firms with female CFOs are associated with a 232 percentage point higher firm performance compared to that of firms with male CFOs. In models 6 and 7, the coefficients for the CFO gender variable remain non-significant for both ROA and ROE.

So far, we find a significant positive relationship between female CEOs and ROA. By controlling for unobserved firm fixed effects in model 6 and 7, the relationship is significant also when removing CFO characteristic controls. Our initial findings suggest firms led by female CEOs are, on average, associated with roughly a 20 percentage point higher ROA relative to that of firms led by male CEOs. The results are significant at the .05 level when excluding CFO characteristic controls. When controlling for both CEO and CFO characteristics, the relationship is significant at the .10 level. The regression results do not,

however, suggest a significant relationship between i) CEO gender and ROE, and ii) CFO gender and firm performance (measured by both ROA and ROE).

Overall, our initial findings suggest a positive relationship between female CEOs and firm performance measured by ROA. We find no other statistically significant relationship between female top executives and firm performance. These findings are in accordance with Khan and Vieito (2013).

Table 5.2: Regression models with CEO- and CFO gender as key variables

	ROA							ROE						
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
CEO gender	0.182	0.53	0.681	0.699	0.123	0.200*	0.213*	0.747	3.022	4.016	4.128	0.281	0.0887	0.0818
	(0.52)	(0.52)	(0.53)	(0.53)	(0.08)	(0.12)	(0.12)	(3.48)	(3.46)	(3.53)	(3.54)	(0.25)	(0.43)	(0.43)
CFO gender	0.00888	0.106	0.195	0.199	-0.107***	-0.04	-0.0367	0.572	1.227	1.86	1.884	-0.125	-0.132	-0.141
	(0.26)	(0.26)	(0.28)	(0.28)	(0.04)	(0.08)	(0.08)	(1.76)	(1.76)	(1.85)	(1.85)	(0.14)	(0.30)	(0.30)
Log (Firm age)		-0.0557	0.00096	0.0105	-0.008	-0.0261	0.082		-0.407	-0.0259	0.0346	-0.024	-0.135	-0.423
		(0.10)	(0.12)	(0.12)	(0.02)	(0.09)	(0.14)		(0.67)	(0.77)	(0.78)	(0.06)	(0.33)	(0.52)
Log (Assets)		0.229***	0.264***	0.265***	0.00786	0.0515	0.0575		1.507***	1.715***	1.721***	0.0209	-0.208	-0.235*
		(0.05)	(0.06)	(0.06)	(0.01)	(0.04)	(0.04)		(0.33)	(0.38)	(0.38)	(0.03)	(0.13)	(0.13)
Year trend				-0.0324	0.00146						-0.205	0.01		
				(0.05)	(0.01)						(0.31)	(0.02)		
Log (CFO tenure)					0.0243*	-0.0025	-0.002					0.049	0.0402	0.0403
					(0.01)	(0.02)	(0.02)					(0.04)	(0.06)	(0.06)
Log (CEO tenure)					0.00994	0.00044	0.00034					0.0562	0.0463	0.0492
					(0.01)	(0.01)	(0.01)					(0.04)	(0.05)	(0.05)
Log (CFO age)					0.0802	0.406**	0.410**					0.236	1.235*	1.184*
					(0.11)	(0.18)	(0.18)					(0.35)	(0.64)	(0.65)
Log (CEO age)					-0.0882	-0.237	-0.224					-0.661*	-1.243**	-1.264**
					(0.11)	(0.16)	(0.16)					(0.38)	(0.59)	(0.59)
Education CEO														
Bachelor					-0.141	-0.186	-0.162					-2.330***	-2.774***	-2.864***
					(0.23)	(0.24)	(0.25)					(0.77)	(0.88)	(0.89)
Master					-0.0761	-0.0538	-0.0368					-2.112***	-2.542***	-2.586***
					(0.23)	(0.25)	(0.25)					(0.76)	(0.89)	(0.90)
PhD					-0.0603	-0.165	-0.155					-1.935**	-2.685***	-2.752***
					(0.24)	(0.27)	(0.27)					(0.80)	(0.98)	(0.99)
Education CFO														
Bachelor					-0.0468	0.219	0.251					-0.213	1.04	0.89
					(0.19)	(0.24)	(0.24)					(0.64)	(0.85)	(0.86)
Master					-0.0204	0.24	0.275					-0.194	0.773	0.623
					(0.19)	(0.23)	(0.24)					(0.64)	(0.84)	(0.86)
Year dummies	No	No	No	No	No	No	Yes	No	No	No	No	No	No	Yes
Industry dummies	No	No	Yes	Yes	Yes	No	No	No	No	Yes	Yes	Yes	No	No
Constant	-0.0862	-3.367***	-4.128***	-4.040***	0.112	-1.447	-1.984	-0.65	-22.09***	-27.23***	-26.67***	3.770*	5.478	7.349
	(0.10)	(0.71)	(1.03)	(1.04)	(0.64)	(1.08)	(1.24)	(0.67)	(4.77)	(6.91)	(6.96)	(2.15)	(3.91)	(4.48)
N	651	651	651	651	577	577	577	651	651	651	651	577	577	577
R^2	0.0002	0.0349	0.0438	0.0446	0.0768	0.0406	0.0495	0.0002	0.0335	0.0431	0.0438	0.0716	0.0609	0.0723

* p < 0.10, ** p < 0.05, *** p < 0.01. Standard errors in parentheses. The base group for Gender CFO and Gender CEO is male.

For CEO and CFO education, the base group is "None". Dummy variables for industry and Year are not included in the table.

Table 5.3: Regression models with gender CEO as the key variable

	ROA							ROE						
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
Gender CEO	0.182	0.524	0.67	0.687	0.118*	0.215**	0.225**	0.719	2.948	3.907	4.015	0.212	-0.0484	-0.0528
	(0.52)	(0.52)	(0.53)	(0.53)	(0.07)	(0.11)	(0.11)	(3.47)	(3.46)	(3.53)	(3.54)	(0.24)	(0.41)	(0.41)
Log (Firm age)		-0.0487	0.00793	0.0174	-0.00317	-0.0326	0.0476		-0.325	0.0407	0.1	-0.0054	0.168	-0.123
		(0.10)	(0.12)	(0.12)	(0.02)	(0.08)	(0.13)		(0.66)	(0.77)	(0.78)	(0.05)	(0.31)	(0.48)
Log (Assets)		0.227***	0.258***	0.259***	0.0103	0.0649**	0.0701**		1.482***	1.663***	1.669***	0.0202	-0.206*	-0.241*
		(0.05)	(0.06)	(0.06)	(0.01)	(0.03)	(0.03)		(0.32)	(0.38)	(0.38)	(0.03)	(0.12)	(0.13)
Year (trend)				-0.0318	-1.53E-05						-0.2	0.0164		
				(0.05)	(0.01)						(0.31)	(0.02)		
Log (CEO tenure)					0.0156	-0.0014	-0.002					0.0830**	0.0359	0.0385
					(0.01)	(0.01)	(0.01)					(0.04)	(0.05)	(0.05)
Log (CEO age)					-0.0959	-0.206	-0.191					-0.726**	-0.74	-0.758
					(0.10)	(0.14)	(0.14)					(0.35)	(0.54)	(0.54)
Education CEO														
Bachelor					-0.125	-0.27	-0.257					-2.166***	-3.065***	-3.123***
					(0.22)	(0.23)	(0.23)					(0.76)	(0.86)	(0.87)
Master					-0.0546	-0.166	-0.155					-2.033***	-2.864***	-2.884***
					(0.22)	(0.23)	(0.23)					(0.76)	(0.87)	(0.88)
PhD					-0.0637	-0.263	-0.261					-1.880**	-2.956***	-2.979***
					(0.23)	(0.25)	(0.26)					(0.79)	(0.96)	(0.97)
Year dummies	No	No	No	No	No	No	Yes	No	No	No	No	No	No	Yes
Industry dummies	No	No	Yes	Yes	Yes	No	No	No	No	Yes	Yes	Yes	No	No
Constant	-0.0849	-3.344***	-4.018***	-3.930***	0.362	0.139	-0.25	-0.568	-21.82***	-26.18***	-25.63***	4.533***	8.376***	10.03***
	(0.09)	(0.71)	(1.02)	(1.03)	(0.44)	(0.76)	(0.90)	(0.62)	(4.75)	(6.83)	(6.88)	(1.55)	(2.89)	(3.40)
N	651	651	651	651	638	638	638	651	651	651	651	638	638	638
R^2	0.0002	0.0347	0.0431	0.0438	0.0522	0.0284	0.0367	0.0001	0.0328	0.0416	0.0422	0.0504	0.0368	0.0472

* p < 0.10, ** p < 0.05, *** p < 0.01. Standard errors in parentheses. For CEO and CFO education, the base group is "None".

Dummy variables for industry and year are not included in the table.

Table 5.4: Regression models with gender CFO as the key variable

	ROA							ROE						
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Gender CFO	0.007	0.098	0.184	0.187	0.250	-0.447	-0.349	0.562	1.180	1.796	1.815	2.319	-2.789	-2.165
	(0.26)	(0.26)	(0.28)	(0.28)	(0.32)	(0.65)	(0.65)	(1.75)	(1.76)	(1.85)	(1.85)	(2.12)	(4.37)	(4.38)
Log (Firm size)		0.223**	0.255**	0.256**	0.264**	2.879**	2.920**		1.469**	1.663**	1.668**	1.731**	18.77**	19.010**
		(0.05)	(0.06)	(0.06)	(0.06)	(0.24)	(0.24)		(0.32)	(0.38)	(0.38)	(0.43)	(1.62)	(1.63)
Log (Firm age)		-0.057	-0.002	0.006	-0.023	-0.598	0.776		-0.413	-0.046	0.009	-0.157	-4.448	3.717
		(0.10)	(0.12)	(0.12)	(0.14)	(0.71)	(1.11)		(0.67)	(0.77)	(0.78)	(0.91)	(4.74)	(7.46)
Year			-0.030	-0.023						-0.189	-0.155			
			(0.05)	(0.05)						(0.31)	(0.35)			
Log (CFO age)				-0.131	-1.317	-0.942					-1.189	-9.886	-7.497	
				(0.81)	(1.41)	(1.42)					(5.40)	(9.47)	(9.51)	
Log (CFO tenure)				-0.00297	-0.046	-0.035					-0.145	-0.297	-0.230	
				(0.10)	(0.13)	(0.13)					(0.66)	(0.89)	(0.88)	
Education CFO														
Bachelor				-0.651	-0.985	-0.288					-4.414	-6.972	-2.711	
				(1.48)	(1.88)	(1.90)					(9.92)	(12.60)	(12.74)	
Master				-0.320	-1.073	-0.348					-2.402	-7.754	-3.326	
				(1.48)	(1.86)	(1.89)					(9.93)	(12.50)	(12.68)	
Year dummies	No	No	No	No	No	Yes	Yes	No	No	No	No	No	Yes	Yes
Industry dummies	No	No	Yes	Yes	Yes	No	No	No	No	Yes	Yes	Yes	No	No
N	651	651	651	651	588	588	588	651	651	651	651	588	588	588
R^2	0	0.0333	0.0413	0.042	0.0468	0.2267	0.2408	0.0002	0.0324	0.0412	0.0417	0.0465	0.2166	0.2294

* p < 0.10, ** p < 0.05, *** p < 0.01. Standard errors in parentheses. The base group for Gender CFO male.

For CFO education, the base group is "None". Dummy variables for industry and Year are not included in the table.

5.2 Robust regression results

In the following, we present the results from the robust regressions. We use Koencker-Basett (1978)[39] robust regressions, which give less weight to outlying observations.

The output shows notable changes in magnitude and significance of the key variables. This indicates that our findings are sensitive to outliers in our sample. On the other hand, this strong presence of sensitivity does not come as a big surprise. We saw from table 3.3 in chapter 3 that there was large variation in firm performance measures between the observations in our sample. The results of the robust regressions are presented in tables 5.5-5.8, with *executive diversity*, and *CEO* and *CFO gender* as the key variables of interest respectively. Specifically, the tables are constructed in the following manner; Column (6) is equivalent to column (1), and represents regression model 1, except for having ROE instead of ROA as the dependent variable. The same is true for columns (7) through (10). As for the initial regression models, control variables are included in a stepwise manner in columns (2) - (5), building on the simple model in column (1).

5.2.1 Top executive diversity

In Table 5.5, we investigate the relationship between top executive gender diversity and firm performance when running robust regressions and compare the results to those obtained from the initial regression models in Table 5.1.

We note that the coefficients for the *executive diversity* variable are negative for all models and that the standard errors of the key variables drop significantly compared to that of the initial regression. The key variable coefficients are, however, still non-significant for all regression models, consistent with the initial findings. The coefficient of determination (R^2) of the robust regressions are, in general, higher than those found in the initial regression models. The R^2 of model 5 is 12.08 percent for ROA and 12.39 percent for ROE in Table 5.4, compared to 6.42 percent (ROA) and 6.81 percent (ROE) in Table 5.1. Due to some missing

[39] See Koenker and Bassett (1978)

values for executive level characteristics in the dataset, the number of observations is lower for the regression models that includes control variables for these characteristics. This is the case for both the initial- and the robust regression models, with the number of observations for model 5 being reduced to 577.

Overall, we find that the key variable, executive diversity, seems to be highly sensitive to extreme observations. However, it remains non-significant when running robust regressions.

Table 5.5 – Robust regression models with executive diversity as the key variable

	ROA					ROE				
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Executive diversity	-0.00986	-0.00705	-0.00462	-0.00453	-0.0026	-0.0146	-0.00427	-0.0106	-0.0104	-0.00513
	(0.0069)	(0.0070)	(0.0071)	(0.0071)	(0.0085)	(0.0147)	(0.0142)	(0.0142)	(0.0142)	(0.0168)
Log (Firm size)		0.00256*	0.00580**	0.00581**	0.00740**		0.0157**	0.0153**	0.0152**	0.0161**
		(0.0014)	(0.0016)	(0.0016)	(0.0019)		(0.0028)	(0.0032)	(0.0032)	(0.0038)
Log (Firm age)		-0.00645*	-0.00176	-0.00191	-0.00277		-4E-05	-0.00153	-0.00167	-0.00266
		(0.0028)	(0.0032)	(0.0032)	(0.0039)		(0.0058)	(0.0064)	(0.0064)	(0.0078)
Year				0.00073	0.00094				0.00109	0.00073
				(0.0013)	(0.0015)				(0.0025)	(0.0029)
Log (CEO age)					-0.00928					-0.0293
					(0.0249)					(0.0492)
Log (CFO age)					-0.0161					0.0141
					(0.0233)					(0.0460)
Log (CFO tenure)					0.00845**					0.0184**
					(0.0029)					(0.0058)
Log (CEO tenure)					0.00078					0.0062
					(0.0029)					(0.0056)
Education CEO										
Bachelor					0.0383					0.213*
					(0.0507)					(0.1000)
Master					0.0264					0.186*
					(0.0506)					(0.0997)
PhD					0.00508					0.128
					(0.0529)					(0.1040)
Education CFO										
Bachelor					-0.00687					-0.0266
					(0.0426)					(0.0840)
Master					-0.0136					-0.0226
					(0.0425)					(0.0838)
Industry dummies	No	No	Yes	Yes	Yes	No	No	Yes	Yes	Yes
N	651	650	650	650	577	651	650	650	650	577
R^2	0.0031	0.0136	0.1002	0.1007	0.1208	0.0015	0.0519	0.0912	0.0913	0.1239

* p < 0.10, ** p < 0.05, *** p < 0.01. Standard errors in parentheses. For Executive diversity, the base group is "Non-diverse". For CEO and CFO education, the base group is "None". Dummy variables for Industry are not included in the table.

5.2.2 Female top executives

Table 5.6 displays the robust regression results of the relationship between female top executives and firm performance. The initial findings presented in section 5.1.2 become more significant in the robust regressions. Most importantly, the relationship between female CEOs and ROA remains positive, while the statistical significance of the coefficients increase (from the .10 to .05 level of significance). Further, the magnitude of the coefficient decreases. The female CEO coefficient also becomes significant for ROE at the .10 (significance) level. When controlling for firm- and executive-level characteristics in model 5, a female CEO is associated with a 4.89 and 7.53 percentage point increase in ROA and ROE, respectively. We find similar results when removing CFO characteristic controls.

The relationship between female CFOs and firm performance has changed from being non-significant to being significant and negative at the .10 level for models 3 and 4, this is the case for both ROA and ROE. However, the female CFO coefficient remains non-significant and negative when controlling for executive characteristics in model 5 for both firm performance measures. When we remove control variables for CFO characteristics, shown in Table 5.7, the female CEO coefficient becomes significant at the .10 level. When excluding CEO characteristics, Table 5.8, the CFO gender coefficients are negative for all models. Several of the models provide statistically significant parameter estimates, but only at the .10 level.

Overall, the robust regression results deviate slightly from the initial results. However, we arrive at the same indications as for the initial results, with a positive relationship between female CEOs and ROA, and a non-significant relationship between female CFOs and firm performance (ROA and ROE). Thus, it seems reasonable to conclude that there is evidence of female CEOs being associated with higher firm performance, relative to that of male CEOs.

Table 5.6 – Robust regression models with CEO- and CFO gender as key variables

	ROA					ROE				
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Gender CEO	0.0358*	0.0369*	0.0454**	0.0455**	0.0489**	0.0438	0.0728*	0.0711*	0.0707*	0.0753*
	(0.0148)	(0.0150)	(0.0147)	(0.0147)	(0.0168)	(0.0316)	(0.0295)	(0.0292)	(0.0290)	(0.0325)
Gender CFO	-0.0164*	-0.0136*	-0.0131*	-0.0131*	-0.0109	-0.0268*	-0.0182	-0.0261*	-0.0261*	-0.0206
	(0.0075)	(0.0077)	(0.0077)	(0.0077)	(0.0092)	(0.0159)	(0.0150)	(0.0153)	(0.0152)	(0.0178)
Log (Firm size)		0.00247*	0.00605**	0.00607**	0.00757**		0.0160**	0.0160**	0.0159**	0.0164**
		(0.0014)	(0.0016)	(0.0016)	(0.0019)		(0.0028)	(0.0032)	(0.0032)	(0.0037)
Log (Firm age)		-0.00566*	-0.00074	-0.00087	-0.00159		0.00168	-2.8E-05	-7.3E-05	-0.00138
		(0.0029)	(0.0032)	(0.0032)	(0.0039)		(0.0057)	(0.0064)	(0.0064)	(0.0076)
Year				0.00059	0.0008				0.00116	0.0009
				(0.0013)	(0.0015)				(0.0025)	(0.0029)
Log (CEO age)					-0.0153					-0.0352
					(0.0249)					(0.0481)
Log (CFO age)					-0.00955					0.0218
					(0.0233)					(0.0451)
Log (CFO tenure)					0.00866**					0.0183**
					(0.0029)					(0.0057)
Log (CEO tenure)					0.00218					0.00813
					(0.0029)					(0.0056)
Education CEO										
Bachelor					0.0268					0.198*
					(0.0507)					(0.0980)
Master					0.0175					0.177*
					(0.0505)					(0.0977)
PhD					-0.00393					0.121
					(0.0528)					(0.1020)
Education CFO										
Bachelor					-0.00779					-0.0291
					(0.0426)					(0.0823)
Master					-0.0107					-0.0199
					(0.0425)					(0.0821)
Industry dummies	No	No	Yes	Yes	Yes	No	No	Yes	Yes	Yes
N	651	650	650	650	577	651	650	650	650	577
R^2	0.0165	0.0239	0.1146	0.1147	0.136	0.0074	0.0613	0.1023	0.1031	0.1395

* p < 0.10, ** p < 0.05, *** p < 0.01. Standard errors in parentheses. The base group for Gender CFO and Gender CEO is male. For CEO and CFO education, the base group is "None". Dummy variables for industry are not included in the table.

Table 5.7 – Robust regression models with gender CEO as the key variable

	ROA					ROE				
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Female-led	0.0363*	0.0359*	0.0463**	0.0467**	0.0465**	0.0464	0.0742*	0.0723*	0.0727*	0.0736**
	(0.0148)	(0.0149)	(0.0147)	(0.0148)	(0.0147)	(0.0310)	(0.0297)	(0.0286)	(0.0289)	(0.0280)
Log (Firm size)		0.00273*	0.00649**	0.00653**	0.00718**		0.0165**	0.0167**	0.0168**	0.0171**
		(0.0014)	(0.0016)	(0.0016)	(0.0016)		(0.0028)	(0.0031)	(0.0031)	(0.0031)
Log (Firm age)		-0.00653*	-0.00108	-0.00124	5.4E-05		0.00015	-0.00048	-0.00078	0.00209
		(0.0028)	(0.0032)	(0.0033)	(0.0032)		(0.0057)	(0.0062)	(0.0063)	(0.0062)
Year				0.00054	0.0008				0.0011	0.0008
				(0.0013)	(0.0013)				(0.0025)	(0.0024)
Log (CEO age)					-0.019					-0.0336
					(0.0210)					(0.0399)
Log (CEO tenure)					0.00399*					0.0121**
					(0.0024)					(0.0045)
Education CEO										
Bachelor					0.0277					0.193*
					(0.0459)					(0.0874)
Master					0.0225					0.183*
					(0.0458)					(0.0872)
PhD					-0.00309					0.117
					(0.0481)					(0.0914)
Industry dummies	No	No	Yes	Yes	Yes	No	No	Yes	Yes	Yes
N	651	650	650	650	638	651	650	650	650	638
R^2	0.0091	0.0185	0.1108	0.1102	0.133	0.0034	0.0589	0.1015	0.1008	0.1421

* p < 0.10, ** p < 0.05, *** p < 0.01. Standard errors in parentheses. For CEO education, the base group is "None".

Dummy variables for industry are not included in the table.

Table 5.8: Robust regression models with gender CFO as the key variable

	ROA					ROE				
	(1)	(2)	(3)	(4)	(5)	(1)	(2)	(3)	(4)	(5)
Gender CFO	-0.0158*	-0.0127*	-0.0130*	-0.0129*	-0.0161*	-0.0273*	-0.018	-0.0267*	-0.0268*	-0.026
	(0.007)	(0.008)	(0.008)	(0.008)	(0.009)	(0.016)	(0.015)	(0.015)	(0.015)	(0.018)
Log (Firm size)		0.00239*	0.00555**	0.00556**	0.00643**		0.0153**	0.0147**	0.0147**	0.0146**
		(0.001)	(0.002)	(0.002)	(0.002)		(0.003)	(0.003)	(0.003)	(0.004)
Log (Firm age)		-0.00601*	-0.001	-0.002	-0.004		0.001	-0.001	-0.001	-0.005
		(0.003)	(0.003)	(0.003)	(0.004)		(0.006)	(0.006)	(0.006)	(0.008)
Year				0.001	0.000				0.001	0.001
				(0.001)	(0.001)				(0.003)	(0.003)
Log (CFO age)					-0.020					0.002
					(0.023)					(0.046)
Log (CFO tenure)					0.00970**					0.0203**
					(0.003)					(0.006)
Education CFO										
Bachelor					-0.011					-0.053
					(0.043)					(0.084)
Master					-0.019					-0.040
					(0.043)					(0.085)
Year dummies	No	No	No	No	No	No	No	No	No	No
Industry dummies	No	No	Yes	Yes	Yes	No	No	Yes	Yes	Yes
N	651	650	650	650	587	651	650	650	650	587
R^2	0.007	0.016	0.103	0.104	0.111	0.005	0.054	0.095	0.094	0.101

* p < 0.10, ** p < 0.05, *** p < 0.01. Standard errors in parentheses. The base group for Gender CFO male.

For CFO education, the base group is "None". Dummy variables for industry and Year are not included in the table.

5.3 Summary of the results

This section summarizes the results presented in the previous sections and provides conclusions for our three hypotheses.

In our first null hypothesis, we hypothesized that firms characterized as diverse would perform better, on average, than firms characterized as non-diverse. The initial regression results did not provide statistically significant coefficients for the executive diversity variable. Thus, the data from our sample does not suggest a difference in firm performance between firms with executive diversity and firms without executive diversity. Further, the robust regression results show that our sample is sensitive to outliers, but the results do not change the fact that we have a non-significant relationship. We fail to reject the null hypothesis due to non-significant coefficients of the key variable, *executive diversity*. We emphasize that failing to reject the null hypothesis not necessarily means there is support for the null hypothesis. For our sample, the data does not indicate a statistically significant relationship between executive gender diversity and firm performance in neither direction.

In the second null hypothesis, we hypothesized that firms managed by female CEOs would perform better, on average, than firms managed by male CEOs. The results from the initial regressions were mixed. However, the fixed effect regressions controlling for unobserved firm heterogeneity provided statistically significant (at .10 level) evidence of firms with female CEOs to have a higher ROA, on average, compared to firms with male CEOs. The robust regressions provided stronger evidence for this relationship for both performance measures, though especially when using ROA as the dependent variable, with several of the robust regression models indicating a positive relationship at the .05 (significance) level. In conclusion, we fail to reject the second null hypothesis, and find weak statistical evidence that firms led by female CEOs perform better, on average, relative to that of firms led by male CEOs.

For our third null hypothesis, we hypothesized that firms with female CFOs would perform better, on average, relative to that of firms led by male CFOs. The initial regressions results were mixed. Robustness checks provided negative coefficients for all models, and for some models the negative coefficients were significant at the .10 level. We find weak evidence for rejection of the null hypothesis. However, since the evidence is weak and non-significant when controlling for individual characteristics, we find it reasonable not to reject the null hypothesis.

6. Discussion

Recall the research question presented in chapter 1: *What impact does gender diversity among top executives have on financial performance for Norwegian listed firms?* The previous chapter provided a presentation of the results from the empirical analysis aimed at answering this question. In this chapter, we provide a qualitative discussion of the findings from the regression analysis, followed by suggestions for further research.

This study contributes to existing literature by providing insight into the relationship between top executive gender diversity and firm financial performance. While the impact of CEO gender on firm performance is a topic that has a growing body of research, there seems to be a gap in the literature concerning the partial effects of CFO gender. In addition, our study contributes to the field of gender diversity by providing evidence from Norwegian-listed companies. There is growing interest in the role of the CFO in the literature, and when studying the strategic partnership between CEOs and CFOs, Han, Zhang and Han (2015) suggested that CEOs should give CFOs more opportunities to participate in strategic decision-making.

The results from the empirical analysis leads us to an inconclusive answer to the initial research question. On the one hand, results from the regression analysis suggest a positive relation between female CEOs and firm performance, relative to that of male CEOs. On the other hand, we do not find any significant impact of top executive gender diversity on firm performance. Neither do we find a statistically significant relationship between the partial gender effect of the CFO and firm performance. The non-significant diversity relationship is in line with Kochan et.al (2003), who found few directs effects of gender diversity on firm performance in their study of US companies. Further, they argue that although diversity itself might not naturally translate to a change, for the better or worse, in firm performance, diversity is "both a labor-market imperative and societal expectation and value" (Kochan, et al., 2003, p. 18).

Evaluating the impact of CEO gender on firm performance measured by ROA, our findings point towards firms with female CEOs to outperform firms led by male CEOs on average. This is in line with the US study undertaken by Khan and Vieito (2013). Although our results are indecisive on the effect of executive diversity on an aggregate level, it may be the case that certain gender-role combinations are associated with better firm performance than others. Further research exploring such combinations in more depth could also provide an interesting

connection to the research on the strategic partnership between the CEO and CFO, specifically targeting how composition of gender and executive roles may relate to performance measures.

An important note on interpretation of the findings relates to the characteristics of the sample in our study. As displayed in chapter 3.4, we saw that both ROA and ROE between and within firms had some extreme observations. This might explain a large standard error of the key coefficient for some of the regression results. The standard errors for the key variable coefficients in the initial regression models are large relative to the robust regressions. In fact, the reduced standard errors provide evidence of that the regression results are highly sensitive to extreme observations. The observed R^2 for each of the initial regression models is small and suggest that there are other explanatory factors not included in our models that are important in explaining firm performance.

When interpreting the results, it is important to keep in mind the direction of causality. Although we find evidence suggesting that firms led by female CEOs, on average, perform better than that of male-led, the interpretation is not necessarily straight forward. It might be the case that the female top executives choose to work for the already high performing firms. The relatively few women who can climb to the top of the corporate ladder might be qualified enough to a point where they have more choices of where to work compared to their male counterparts. A potential underlying cause being that female top executives might have to overcome higher barriers than their male peers along the way. Furthermore, as Smith, Smith and Verner (2006) points out, the firms that can attract female top executives might have the most progressive and ambitious approach to (gender) diversity. If such unobserved characteristics are present, it might also be the case that other unobserved characteristics of the firm exist, such as the company culture, that attract top female managers, and that these unobserved characteristics affect firm performance.

6.1 Limitations and suggestions for further research

During the process of writing the thesis, we have encountered and discussed potential extensions to our approach, as well as alternative approaches. Below we present some of these in the form of suggestions for further research. When evaluating the results from our study, it is also important to consider the limitations and potential drawbacks associated with our approach. A clarification of the limitations allows for a better understanding of the findings and their possible applications for further research.

Although the available data of female top executives in itself is rather limited, we want to emphasize that the size of our final sample is rather small. This is illustrated through the robustness check that we ran for the empirical analysis, which points to how sensitive the regression results are to outlier s in the dataset. The reader should be cautious about extending the results from our study towards i) companies outside a Norwegian context, ii) non-listed Norwegian companies, and iii) diversity and gender measures at a lower hierarchical level than that of the CEO and CFO.

When sampling our data, we chose to apply several decision criteria that dropped certain firms and created a balanced panel dataset. By instead gathering data for a larger sample of Norwegian listed ASAs or even more broadly, including unlisted Norwegian ASAs, the research findings could provide a more representative picture of the Norwegian context. As the SNF database to this date provides data up until 2016, including data for more recent years would also add to the potential sample size. A larger sample size could also make it more relevant to measure the effect of top executive gender diversity and female representation across different industries. Looking at Figure 3 in chapter 3.4.3, the degree of gender diversity varies notably between the different industries for our sample. As suggested by e.g. King and Cornwall (2007), female executives might have an advantage in certain sectors targeting mainly females and vice versa for male executives.

With the low number of observed female top executives for the Norwegian listed firms being a key limiting factor for our study, including more years of data would help tackle this to some degree. It is important to keep in mind that this study examines a rather small sample of the listed Norwegian firms. Gathering the data on top executive characteristics was a time-consuming process and imposed a trade-off for each additional year included in our study, a contributing factor to our restriction of analysing the period 2010-2016. Including data further

back than 2010 would also providing an opportunity to explore the effects of the financial crisis on the empirical results, and to see how the financial downturn would affect the results.

Our results give some indications that certain role-gender compositions within the top executive suite of the firms in our sample might, on average, be associated with higher firm performance than other combinations. Addressing this in more depth could be interesting, with an potential extension being to include more top management team individuals from each firm to the study besides the CEO and CFO.

As Murray (1989) points out, when studying the impact of top management and their strategic actions on firm financial performance, the lag between cause and effect is variable, as is the duration of the effect. He further argues that this presents methodological problems when trying to study this link. An approach such as ours, focusing on backward-looking short-term performance measures such as ROA and ROE, will therefore be prone to such a problem. Other measures of firm performance could be included in the empirical analysis in a way to around such an issue. A benefit of analysing listed companies is the opportunity to include market-based measures. Tobin's Q, often calculated as the ratio between the firms' market value of equity and liabilities with the corresponding book values, is a one such measure that is commonly used as a proxy for firm performance.[41]

[41] See for example Peni (2014) who examines the relationship between CEO and Chairperson characteristics and firm performance measured by ROA and Tobins Q.

7. Conclusion

The aim of this study is to examine the impact of gender diversity among top executives on financial performance for Norwegian-listed firms. Based on empirical analysis of 93 companies from 2010 to 2016, and controlling for firm characteristics and individual differences such as tenure, age, and education, we are able to compare the gender diversity-performance effect across companies. We use ROA and ROE as measures for firm performance, and representation of both genders among the CEO and CFO of a company as a proxy for diversity. Interestingly, we find that firms led by female CEOs tend to outperform firms led by male CEOs. However, we find no decisive evidence of a gender-performance effect amongst CFOs. Finally, we find no statistical evidence that firms with both genders seated in the top executive suite (CEO and CFO) perform better, on average, than that of firms with only one of the genders represented. Our study fills a gap in the existing literature on gender diversity by investigating the effect of gender diversity on the top executive level, by particularly focusing on the CEO and CFO in a Norwegian context.

Our findings are interesting as they contribute to the debate and growing advocacy for female participation in top management. On International Women´s day 2019, a Norwegian bank, Nordea, launched a mutual fund with the sole purpose of investing only in companies where women make up for at least one third of the top management. Goldman Sachs has stepped up efforts to close the gender gap, and announces in 2018 that they would invest $500 million in companies led by women. The findings provide new insights into how gender of the CEO in Norwegian-listed firms may affect the firms level of performance. The paradox of the low representation of female top executives is, as Norway´s minister for children and equality stated, of national importance.

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Appendix A – Variables

Table A1: Firm specific variables collected from SNF

Variable name	*Description*
orgnr	Nine-digit organisation number. Used in the sample selection process
aar	Accounting year. Used in the sample selection process
sector	Industry group. Used as dummy control variable(s) in the regressions
firm_age	Firm age. Number of years since establishment
aarsrs	Net income. Used for generating ROA and ROE
sumeiend	Total assets. Used as proxy for firm size
ek	Equity. Used for generating ROE
aktiv	Whether the company is active or not. Used in the sample selection process
selskf	Legal form of a company. Used in the sample selection process

Table A2: Executive characteristics for CEO and CFO, hand collected

Variable name	*Description*
Gender	Gender of the executive. 1 if female, 0 otherwise
Birth year	Birth year of the executive. Used for computing age
Date appointed in firm	Month and year the executive was appointed to the firm
Date appointed in role	Month and year the executive was appointed to their role as CEO/CFO
Education	Highest degree of education obtained by the executive

Table A3: Executive characteristics for CEO and CFO, generated from hand collected data

Variable name	*Description*
Tenure in role	Measure of the executives tenure in role. Measured in years. Computed by subtracting date of appointment in role from the year of the observation
Tenure in firm	Measure of the executives tenure in the firm. Measured in years. Computed by subtracting date of appointment in role from the year of the observation
External	Dummy variable giving the value 1 if the executive is an external hire (tenure in role = tenure in firm).
New	Dummy variable giving the value 1 if the executive was appointed in the role in the year the observation was made
Age	Age of the executive in a given observation (year). Computed by subtracting their birth year from the year of the observation
Quality	Proxy of quality measure of the executive.

Table A4: Dependent variables – measures of firm performance

Variable name	*Description*
ROA	Return on assets. Computed as net income divided by total assets
ROE	Return on equity. Computed as net income divided by equity

Table A5: Independent diversity variables

Variable name	*Description*
Executive diversity	Dummy variable 1 if Gender CEO ≠ Gender CFO in a given firm in a given year. 0 otherwise
Gender CEO	Dummy variable 1 if the CEO in a given firm in a given year is female
Gender CFO	Dummy variable 1 if the CFO in a given firm in a given year is female

Table A6: Control variables

Variable name	***Description***
Firm controls	
Log (Firm age)	Logarithmic scale of *Firm age*
Log (Firm Size)	Logarithmic scale of firm size. Size measured by *Total Assets*
Industry	Dummy variable for 11 industries
Executive controls	
Log (Age)	Logarithmic scale of *Executive age*
Log (Tenure)	Logarithmic scale of *Executive tenure in firm*
Education	Dummy variable for highest degree of education obtained by the executive

Appendix B – Descriptive Statistics

Figure B1 – Gender of CEO by industry