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Firm Performance and CEO Turnover in Private Family Firms: Evidence from Norway

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Title: Firm Performance and CEO Turnover in Private Family Firms: Evidence from Norway

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Keywords: CEO turnover, Corporate governance, Firm performance, Monitoring, Chief executive officer, Family firms, Private firms, Norway

Purpose: To examine the relationship between CEO turnover and firm performance in private Norwegian family firms with the moderating effect of family ownership

Methodology: The logistic model is applied to assess the relationship between CEO turnover and prior firm performance. The GLS linear regression is used to analyse post-CEO turnover performance. In addition, we apply the Propensity Score Matching model to analyse firms with similar characteristics. Lastly, we employ the two-stage regression model to assess relative performance.

Findings: This thesis provides evidence that the sensitivity of CEO turnover to prior firm performance is more pronounced in family firms than in non-family firms. Moreover, we find evidence indicating that CEO replacement in family firms is a consequence of effective monitoring.

Originality/value: This study sheds light on a limited researched topic, namely CEO turnover in private family firms. Also unique is the large sample employed thanks to the CCGR (Centre for Corporate Governance Research) database.

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Contents

Abstract

In this paper, we examine the relationship between firm performance and CEO turnover within the dynamics of private firms. More specifically, we will compare and analyse the differences of CEO turnover in private family firms and private non-family firms. Our hypotheses revolve around our research question “Is there a difference between private non-family firms and private family firms in the sensitivity of CEO turnover to prior firm performance, and, if so, is it a result of a difference in monitoring?” Each hypothesis builds on existing theories, such as the classical relationship between firm performance and CEO turnover, agency theory and the stewardship versus stagnation perspective. At the heart of our thesis is the analysis of differences in private non-family and private family firms regarding their CEO turnover to performance sensitivity. Surprisingly, we find that private family firms are significantly more likely to replace their CEO if performance is bad than private non-family firms, as measured by lagged return on assets (ROA). The difference becomes even starker when applying Propensity Score Matching, further supporting our results. The results are robust to different empirical models and alternative performance measures. Our findings are surprising given the well-established longer-term perspective in family firms, which includes less frequent CEO turnovers on average. Thus, we believe our results can spur additional discussion on a still limited literature on CEO turnover in private family firms. Moreover, we analyse whether the CEO turnover decision is a result of better monitoring. We find that private family firms are less likely to fire its CEO based on exogenous shocks as measured by industry-wide shocks, and that firm performance increases significantly more in private family firms than in private non-family firms following a turnover. Additionally, we find a significantly negative relationship between prior firm performance and family firms hiring an outside CEO. In our analysis, we use a comprehensive sample of 182 973 private Norwegian non-family firms and 163 758 private Norwegian family firms retrieved from the CCGR database. The logistic model is employed to analyse the relationship between CEO turnover and firm performance, while the GLS linear regression is used to examine post-CEO turnover performance. Lastly, we employ the two-stage regression model to assess relative performance.

1. Introduction

In this section, we elaborate on the background (1.1) and motivation (1.2) for our research question (1.3). Next, we provide the purpose of the thesis (1.4) as well as the outline for the paper (1.5).

1.1 Background

CEO turnover has long been an instrument used to maximize shareholder value. The literature on the topic is extensive, and early academic papers found a relationship between firm performance and CEO turnover (Coughlan & Schmidt, 1985; Warner, Watts & Wruck, 1988). Early studies also concluded that CEO turnover sensitivity is higher with effective board monitoring (Weisbach, 1988), and Coffee (1999) argues that CEO turnover due to poor firm performance is a sign of successful corporate governance.

The separation between ownership and control can potentially create issues, such as entrenchment, private benefits, and suboptimal investment decisions due to short-termism, to mention a few (Masulis, 1988; Tsai, Kuo & Hung, 2009). These issues arise from conflicts of interest and can be costly for shareholders. Interestingly, theory suggests that family firms may be less exposed to such issues.

Family firms play a notable role in the world economy and contribute significantly to welfare, employment and economic growth (Anderson & Reeb, 2003; La Porta, Lopez-de-Silanes, & Shleifer, 1999; Steier, 2007). Moreover, family firms provide unique dynamics, such as the pursuit of socioemotional goals in conjunction with firm performance (Huybrechts, Voordeckers & Lyabert, 2012). Literature suggests that family owners draw utility from socioemotional wealth in addition to economical, which could include a sense of identity from the firm (Kepner, 1991), family image and reputation (Westhead, Crowling & Howorth, 2001), or the conservation of social capital (Arregle, Hitt, Sirmon & Very, 2007).

However, studies on the effectiveness of corporate governance in family firms have yielded varying results. Some former research suggests that family firms exercise poor corporate governance because of pyramiding and entrenchment (La Porta, Lopez-de-Silanes, & Shleifer, 1999; Claessens, Djankov, & Lang, 2000; Claessens, Djankov, Fan & Lang, 2002). Recent research, however, argues that family firms in fact outperform their non-family counterparts (Anderson & Reeb, 2003; Villalonga & Amit, 2006). The latter implies that family firms possess superior corporate governance mechanisms to non-family firms. The greater firm performance by family-owned firms have in part been linked to reduced principal-agent conflicts which positively affect subsequent generation performance (Blanco-Mazagatos, de Quevedo-Puente & Delgado-Garcia, 2016).

A complicating factor when researching CEO turnover in family firms is whether the CEO is related to the owning family. Some research results indicate that family CEOs perform better than outside CEOs because of higher non-monetary rewards (Kandel & Lazear, 1992; Davis, Schoorman & Donaldson, 1997), greater firm-specific knowledge and higher levels of trust (Donnelley 1964), as well as longer-term focus (Cadbury, 2000). On the other hand, an Achilles heel for having family CEO is potential tensions within the family which may affect firm performance (Christiansen 1953; Levinson 1971; Barnes and Hershon 1976; Lansberg 1983), in addition to the fact that selecting a family member means picking a CEO from a small pool of potential suitors. Some academic papers also find that succession of a family member following CEO turnover has a large negative impact on firm performance (Bennedsen, Nielsen, Perez-Gonzalez & Wolfenzon, 2007).

1.2 Motivation

The CEO is supposed to drive shareholder value (Lazonick & O'Sullivan, 2000). Consequently, CEO turnover is arguably one of the most important corporate decisions (Chen, Cheng & Dai, 2013; Huson, Parrino & Starks, 2001) and is therefore a highly relevant topic.

However, the majority of the literature on CEO turnover involves public firms. Public firms, in contrast to private firms, provide easily accessible information to outsiders, so that monitoring management might be simpler. Being under greater scrutiny to the public eye may induce the manager to work hard, and consequently enhance firm performance (Holmström & Tirole, 1993). We therefore find it interesting to study CEO turnover in private firms, both family and non-family, where the literature is much more limited and the dynamics quite different. Moreover, with the extensive dataset provided by CCGR on private Norwegian firms, we are uniquely positioned to provide robust research on the topic.

In addition, we look into the monitoring aspect of the CEO turnover decision. We argue that the CEO turnover decision should be made independent of exogenous shocks and that replacing a poorly performing CEO should increase firm performance following the CEO turnover. This would imply effective monitoring. Because of the contrasting views on corporate governance in family firms, we are excited to explore this topic further.

We believe our research can contribute to an important but complex topic, where the literature has provided varying results in the past. Our main contribution will be to shed light on the unexplored relationship between CEO turnover and prior firm performance in a Norwegian context with the moderating effect of firm status (family versus non-family), as well evidence on effective monitoring.

1.3 Research Question

Our research question is as follows: “Is there a difference between private non-family firms and private family firms in the sensitivity of CEO turnover to prior firm performance, and, if so, is it a result of a difference in monitoring?”

The economic argument of replacing a CEO is simply that unsatisfactory firm performance should lead to a consequence, such as firing the manager. Hence, we expect a negative relationship between CEO turnover and prior firm performance. Moreover, given the longer-term nature of family firms, we expect that family firms are less sensitive to poor firm performance in replacing their CEO than non-family firms.

We explore whether any difference between private family firms and private non-family firms in CEO turnover to prior firm performance sensitivity is a result of better monitoring. We argue that an efficient CEO turnover decision should be made independent of exogenous shocks, and lead to improved firm performance post-turnover. Lastly, there is the complicating factor in many family firms of having a relative in the executive position. Building on effective monitoring, we argue that the board should hire an outsider rather than an insider from the limited candidate pool of family relatives when a new strategic direction is desirable.

Thus, this thesis seeks to answer two questions: First, does family ownership affect CEO turnover decision? Second, is the decision a result of effective monitoring?

1.4 Purpose

The purpose of this thesis is to examine the relationship between CEO turnover and firm performance in private Norwegian family firms with the moderating effect of family ownership, and whether the turnover decision is driven by effective monitoring.

1.5 Thesis Outline

Chapter 1	Elaborates on thesis background, motivation, and purpose of the thesis.
Chapter 2	Presents the literature review and hypotheses forming.
Chapter 3	Contains data collection, data description and data filtering.
Chapter 4	Elaborates on research approach, variables used in main regressions and the empirical models employed. The chapter ends by discussing validity.
Chapter 5	Provides the discussion of our empirical results. The chapter ends with robustness checks.
Chapter 6	Presents the conclusion, limitations, and suggestions for further research.

2. Literature Review & Hypotheses Development

In this section, we conduct a literature review. First, we critically review our main sources of the literature. Second, we discuss prior literature on CEO turnover and differences in family and non-family firm characteristics. Lastly, we elaborate on classical theories, leading to our hypotheses.

2.1 Source Criticism

Saunders, Lewis and Thornhill (2009) underline the importance of critically reviewing the literature, as the literature provide the building stones for our study. A critical review of the literature is thus essential so that the literature is properly applied to our research question and used to develop precise insight (Bryman & Bell, 2015). To construct our literature review and get a clear picture of prior research on CEO turnover in relation to firm performance, we used Google Scholar and the Web of Science database provided by BI. We also focused on published, peer-reviewed articles with high citation. Hence, the information gathered is considered trustworthy and increases the reliability of our thesis (Descombe, 2016).

2.2 CEO Turnover

There could be many different reasons for replacing a CEO. A CEO succession could for instance be a result of natural causes, such as resignation, retirement, death, or other reasons not related to governance issues (Messersmith, Lee, Guthrie & Ji 2014). On the other hand, CEO turnover could be a result of strategic action taken by the board of directors. The latter form of CEO turnover is common with principal-agent problem present or if there is potential for improvement in firm performance by replacing the manager. It is also argued that CEO turnover could be used as a symbolic measure made by the board of directors (Zhang & Wiersema, 2009). Such measure is made to exemplify the firm's commitment to change when governance problems occur, or when the firm is performing badly. Hiring a new CEO could impress the market or bring the firm a more competent CEO that can improve its performance (Chen & Hambrick, 2012). Another explanation for turnover is factors outside the CEO's control (Finkelstein & Hambrick, 1996). This can be because the firm wants to get a sense of control and reduce the level of uncertainty (Krug, Wright, Kroll, 2015).

Moreover, given a powerful CEO with severe influence on the board, CEO turnover could be crucial to improve the firm's governance (Zajac & Westohal, 1996). However, Furtado and Karan (1990) state that the main reason for CEO turnover is to correct a suboptimal match between the executive manager and the firm, with the exception of death and retirement.

2.3 Differences between Family Firms and Non-Family Firms

Empirical research on differences in firm characteristics between family firms and non-family firms may explain the effect of being a family firm on CEO turnover. Thus, an important facet in conducting research on family firms is to determine the definition of family firms. Various definitions of family firms have been proposed in the literature. The definition has significant implications for the result of the study. For example, according to Kayser and Wallau (2002), 15% of all enterprises are family firms, while Chrisman (2004) determined that 79% of all enterprises are family firms. This illustrates the implication of different definitions of family firms and is a reason for inconsistent results across studies. For the purpose of our research, we determine family firms as firms where the largest family obtain ultimate equity ownership of more than 50%. Non-family firms are the firms in which the family owns 50% or less of the equity. This approach is consistent with the approach used by Westhead (1997) and Berzins and Bøhren (2013).

Previous empirical studies have shown that the differences between family firms and non-family firms are significant in respect to firm age and size (e.g. Westhead & Cowling, 1998). It is also shown that family firms tend to operate in different sectors and locations than non-family firms (Jorissen, Leveren, Martens & Reheul, 2002). Berzins et al. (2018) confirm the latter statement by showing that Norwegian family firms are more common in certain industries.

Regarding CEO characteristics, previous research (e.g. Cromie, Stephenson & Monteith, 1995; Gallo, 1995) show that CEOs in family firms have notably longer tenures than CEOs in non-family firms. Moreover, family firms and non-family firms differ in internal management styles. Lyman (1991) argues that managers in family firms use a more personal and informal approach to manage the firm.

Essentially, the family wish to preserve personal and social control rather than the use of impersonal and formal approaches (Daily and Dollinger, 1992).

According to Gorriz and Fumas (1996), family firms have better performance than non-family firms. Coleman and Carsky (1999) found that family firms have higher ROE and ROA on average than non-family firms. Recent research on Norwegian family firms show that family firms are more profitable than non-family firms regardless of firm size, industry, and whether the firms have minority owners (Berzins et al., 2018). On the other hand, Berzins et al. (2018) find that family firms have lower growth rates than non-family firms, independently of the size of the firms.

2.4 Theories & Hypotheses Development

In developing our hypotheses, we explored the following theories: The classical relationship between firm performance and CEO turnover (2.4.1), agency theory (2.4.2), and the stewardship versus the stagnation perspective (2.4.3).

2.4.1 The Classical Relationship between Firm Performance and CEO Turnover

One way to assess whether firms have good corporate governance is to study the relationship between CEO turnover and firm performance. A firm with good or strong corporate governance should penalize bad CEO's financial performance (González, Guzmán, Pombo & Trujillo, 2015). The negative relationship between CEO turnover and firm performance has been established internationally in countries including the US (e.g. Huson et al., 2001), Germany (Kaplan, 1994a), Italy (Brunello, Graziano & Parigi, 2003), Finland (Maury, 2006), Belgium (Renneboog, 2000), Venezuela (Garay & González, 2005), Japan (Kang & Shivdasani, 1995), Taiwan (Tsai, 2006), and Thailand (Rachpradit, Tang & Khang, 2012).

Furthermore, the corporate governance mechanism of a firm, including whether to replace a CEO, is affected by its environment. Hence, in countries with strong law enforcement, the relationship between CEO turnover and firm performance is more pronounced (González et al., 2015; DeFond & Hung, 2004). We expect the classical negative relationship between firm performance and CEO turnover to be true for Norwegian firms as well given that Norway is considered a country with strong law enforcement (European Commission, 2016). Hence, we hypothesize the following:

H1: *The likelihood of CEO turnover is negatively related to prior firm performance*

González et al. (2015) also states that family owned firms are exposed to agency conflicts. Therefore, penalizing the CEO that delivers bad financial performance is a corrective mechanism that could be applied to these family firms as well. However, compared to non-family firms, family firms are more closely held and have longer investment horizons (Berzins et al., 2018; Cheng, 2014). Considering this, in addition to the fact that bad firm performance could be driven by factors outside the CEO's control, we argue that family firms are less likely to replace its CEO only because of a year of poor performance. Building on Section 2.3, we believe there is a moderating effect of being a family firm on CEO turnover to firm performance sensitivity and hypothesize the following:

H2: *CEO turnover to prior firm performance sensitivity is lower in family firms than in non-family firms*

2.4.2 Agency Theory

Agency conflict, also referred to as the principal-agent problem, is an important issue to consider when studying the relationship between firm performance and CEO turnover. The agency theory assumptions are a) Owners and managers have conflicting interests, b) Managers may think in their own self-interest and pursue their own goals even if they do not correspond with owners' interests and goals, c) In the presence of asymmetric information, it becomes difficult for owners to observe managers' behaviour, and d) Owners have bounded rationality (Jensen & Meckling 1976; Williamson, 1981). Agency conflicts are difficult to reduce or completely avoid and may result in unnecessary use of resources.

Jensen and Meckling (1976) and Fama and Jensen (1983) argue that agency conflicts may be less prominent in family firms. Berzins et al. (2018) found that

66% of Norwegian private firms are family firms. Moreover, the family is represented both on the board of directors and as the CEO of the firm in 79% of Norwegian family firms (Berzins et al., 2018). These results from Norwegian family firms help mitigate the principle-agent problem, where the owners, the board and the CEO hold together. Reducing this conflict to a sensible level might improve the board's efficient decision-making, which in turn leads to the improvement of firm performance. The latter is supported by Maury (2006) who found that family owners' active control in the firm exhibit firm performance which exceeds that of non-family firms.

Improvement in firm performance following CEO replacement is often considered a sign of good corporate governance (Huson, Malatesta & Parrino, 2004). We believe effective monitoring and low information asymmetry in family firms (Berzins et al., 2018) lead to higher performance following CEO turnover relative to that of non-family firms. Hence our hypothesis:

H3: *Performance following a CEO turnover increase relatively more in family firms than in non-family firms*

In most of the theoretical literature on agency conflicts, such as the principal-agent problem, boards replace the CEO based on poor firm performance and other signals (Holmström, 1979). If CEO performance falls below a certain threshold, the board will often fire him/her. In most cases, conventional agency models do not consider the real CEO quality (Jenter & Kanaan, 2015). A common issue is that the board of directors consider factors that are outside of the CEO's control in assessing the CEO quality. Efficient boards should not fire more CEOs under bad economic situations (e.g. the financial crisis) than under normal economic situations. Due to the closely held nature of family firms, we believe any CEO turnover in family firms is driven by effective monitoring and not from exogenous shocks. Thus, we hypothesize the following:

H4: *CEO turnover decisions in family firms are not affected by exogenous shocks*

2.4.4 Alternative Theories

There are several alternative theories to the agency theory. The stewardship and the stagnation perspective are relevant theories that could explain the relationship between CEO turnover and firm performance in family firms.

2.4.4.1 Stewardship Perspective versus Stagnation Perspective

Much attention has been given to the stewardship perspective in organizational research (Donaldson, 1990; Fox & Hamilton, 1994; Chrisman, 2007), and it is commonly used in studies on family-owned firms. Miller, Le Breton-Miller and Scholnick (2008) mention both stewardship and stagnation as major perspectives on the nature of family-owned firms:

"The stewardship perspective concerns that families are set to care deeply about the long-term prospect of the firm as the family's fortune and reputation is at stake. While stagnation perspective evolved on the basis that families face resource restrictions, practice nepotism and pursue conservative strategies, leading to slow growth and short lives" (Miller, Le Breton-Miller & Scholnick 2008, p. 51).

Several authors support the claim that families have an interest in continuity of the firm (e.g. Casson, 1999; Zellweger, 2007). James (1999) states that the founder of the firm views their firm as an asset that will be carried to the next generation, rather than consuming it during the founder's lifetime. This claim implies that family firms pursue long-term strategies. Miller et al. (2008) found support to the claim where family firms pursue practices such as long-term investments in reputation, market share development, and obtaining positive customer relationships to ensure the long-term sustainability of the firm. They also found that families invest in strategies to help build a motivated team of employees. Moreover, the family invests in the management of the firm, where the family tries to establish common goals and values to align family's and management's incentives. However, Miller et al. (2008) did not find support for the stagnation perspectives in their research.

On the other hand, Schulze, Lubatkin and Dino (2003) and Lubatkin, Ling and Schulze (2007) argued that family firms are subject to stagnation from hiring their own family members. It is argued that such practices could harm the firm's value in the long run, especially when the family hire a CEO from a limited competence pool (Wennberg, Wiklund & Hellerstedt, 2011). Furthermore, according to Sharma, Chrisman, Pablo and Chua (2001), if the existing CEO is not willing to let go of his position, the agency conflict is enhanced. This will in turn harm the firm's success and could have negative effects on its performance.

Both the stewardship and the stagnation perspective suggest that a blood-related CEO of the owning family is more likely to survive than outsider CEOs. Theory suggests that inside CEO successions are related to maintaining the family's long-term strategy. Outside succession on the other hand concerns organizational change (Romanelli & Tushman, 1994). Moreover, compared to family CEOs, outsiders are less emotionally involved (Gomez-Mejia, Haynes, Nunez-Nickel, Jacobsen & Fuentes, 2007) and care more about her/his own market value as an executive, thus favouring strategic change (Cruz, Gomez-Mejia & Becerra, 2010). Therefore, we expect that family firms hire outside CEOs when performance is poor and consequently need a strategic change rather than the status quo. Basically, family firms would realize the need for outside expertise and recognize that it would be inefficient to hire from its own limited candidate pool in such cases. We argue that this indicates effective monitoring. Hence, we hypothesize the following:

H5: *In family firms, the likelihood of outside CEO succession is negatively related to prior firm performance*

2.4.5 Summary of Hypotheses

CEO turnover to prior firm performance sensitivity:

> **H1:** *The likelihood of CEO turnover is negatively related to prior firm performance*
>
> **H2:** *CEO turnover to prior firm performance sensitivity is lower in family firms than in non-family firms*

CEO turnover decision driven by effective monitoring:

> **H3:** *Performance following a CEO turnover increase relatively more in family firms than in non-family firms*

H4: *CEO turnover decisions in family firms are not affected by exogenous shocks*
H5: *In family firms, the likelihood of outside CEO succession is negatively related to prior firm performance*

3. Data & Sample Selection

In this section, we describe the data collection and the data filtering resulting in our final sample of 182 973 private non-family firms and 163 758 family firms, totalling 346 731 firm-year observations.

3.1 Data Collection

Our primary data is collected from the CCGR database, which is recently gathered data directly related to our study and thus dependable (Bryman et al., 2015). The CCGR database provides comprehensive data on Norwegian private firms, which enable us to conduct high quality analysis on the relationship between CEO turnover and firm performance in Norwegian private firms. Moreover, the dataset provides information on for instance family ultimate ownership share and family CEO status, which is considered unique and seldom available in previous research. Worth noting is that the data differs from the ones in classical papers based on public US firms in the sense that Norwegian firms are in general smaller. Nonetheless, our data may provide general insight for countries where family ownership is common and cultural values encourage continuity of the inherited family firm (Bennedsen et al., 2007; Bertrand & Schoar, 2006; La Porta, 1999).

3.2 Data Filtering

The data we extracted from CCGR contains observations on a large sample of Norwegian firms, both family and non-family, with a time horizon spanning from year 2000 to 2017. The initial dataset includes 20 variables and 4 092 593 observations. A list of the variables is provided in Appendix 1**.**

Saunders et al. (2009) states that an appropriate time horizon is essential for a research paper, as the time horizon is one of the study's main characteristics. The time horizon of the research should provide a sufficiently large sample to attain reliable and valid results. Thus, we include all observations spanning from year

2000 to 2017. Another condition is that the research time horizon should represent current circumstances. Abnormal year fluctuations, such as the financial crisis, are accounted for by year dummies, which we elaborate on in Section 4.2.4.

Furthermore, in order to achieve consistent and reliable results on the relationship between CEO turnover and firm performance, we apply the following filters to the whole population:

1. All firms that are not independent are removed.
2. Firms that are listed or that becomes listed during the period are removed.
3. Firms with zero or negative average revenues throughout the period are removed.
4. Firms with negative total assets are removed.
5. Firms with a controlling CEO are removed.
6. Firms that change status from family to non-family firm, or counter wise, are removed.
7. All financial, public and international firms are removed.
8. Firm-observations with interim CEOs (i.e. CEOs with less than one year tenure) are removed.
9. Firms that do not survive a time horizon of 3 consecutive years or more are removed.

The data from CCGR contains both consolidated and unconsolidated firms. The issue with keeping both types is that a given firm can show up twice in the sample data, which could impair our findings. We therefore apply **filter 1**, excluding all dependent firms from our data sample. Keeping only independent firms makes it easier for us to address each firm's characteristics by its variables directly.

Moreover, since we are examining private firms, we apply **filter 2** to exclude all firms that are publicly listed.

We apply **filter 3** and **4** to remove all firms that are economically inactive or with little economic importance (Che & Langli, 2015).

Our thesis is researching CEO turnover, and a controlling CEO is not going to fire himself/herself. On a broader level, we are analysing potential conflicts between shareholders and the CEO resulting in CEO replacement in a setup where the shareholders and the CEO are two separate economic agents. The instance of CEO turnover when a CEO and the majority owner is the same person is a separate case that we are not going to research in this thesis. Thus, **filter 5** is applied. We define a controlling CEO as a CEO with greater than 50% ownership.

Because we want to examine family and non-family firms both separately and in conjunction, we apply **filter 6**. This also makes sense from an econometrics perspective, as we are performing a binary response models with panel data, such that we look for changes within firms. We do not want our findings to be driven by changes in firm status. Moreover, non-family and family firms have notable different firm characteristics (Berzins et al., 2018), and therefore we find it appropriate to only keep firms that maintain their status as either family or non-family firm throughout the period.

Filter 7 removes all firms that are operating in the financial industry, or that are public defence entities or international organizations. This filter is applied because such firms face extraordinary regulation which may affect the CEO turnover dynamics. To avoid inconsistent results, we remove said firms.

Furthermore, **filter 8 and 9** are applied because we want to study the relationship between CEO turnover and performance over time. To properly assess the CEO's performance, the research period has to be sufficiently long. It is also argued that it takes CEOs between 2,5 and 4 years to gain authority within a firm (Gabarro, 1987). Because of this, we remove all interim CEOs, i.e. CEOs with less than one year tenure. For the same reasons, we only keep firms that are present for at least three consecutive years.

In general, the dataset contains many missing values. To exclude an entire record given any single value of a variable is missing would reduce the number of observations significantly and thus weaken the statistical power of our test (Park, 2011). Moreover, Stata deals with missing values automatically. Hence, we do not remove firms with missing values.

Lastly, we adjust all NOK values for inflation using 2015 as the base year. We retrieve inflation data from the Consumer Price Index (CPI) provided by Statistics Norway, the Norwegian statistics bureau (SSB, 2019).

Our final sample constitutes 182 973 private non-family firms and 163 758 family firms, totalling 346 731 firm-year observations. By way of comparison, Jenter et al. (2015) have 16 865 firm-year observations in their classical paper on CEO turnover and relative performance evaluation.

4. Methodology

The fundamental question of our thesis is on the relationship between CEO turnover and prior firm performance. In this section, we elaborate on our research approach to answer our research question (4.1), the variables used in our main regressions (4.2), and the empirical models employed (4.3). We end the chapter by discussing the validity in Section 4.4.

4.1 Research Approach

In this thesis, we use existing theories and research in corporate governance to develop a quantifiable hypothesis into statistical analysis (Saunders et al., 2009). Our research employs empirical analysis combined with deductive reasoning. The empirical models used include non-linear logistic regression model, linear panel data regression, as well as a two-stage estimation model. Moreover, we employ the probit model and the Cox Proportional Hazards model for robustness checks. We will design our thesis such that it presents the relationship between CEO turnover and firm performance in Norwegian family firms compared to Norwegian non-family firms. Therefore, choosing quantitative methods is suitable to answer our research question.

4.2 Variables

In this section, we explain the main variables used in our analysis, including dependent, independent, moderating, and control variables.

4.2.1 Dependent Variable

CEO turnover: In our main regressions (1, 2, 3, and 5), our dependent variable is CEO turnover. We define CEO turnover as a dichotomous variable that takes the value of 1 if there was a replacement of CEO in that year and 0 otherwise. In our dataset, we identify CEO turnover at year t whenever there is a jump in CEO age between year t and t+1, meaning the CEO was replaced during year t.

4.2.1.1 Forced versus Voluntary CEO Turnover

We do not distinguish between forced and voluntary turnover in this thesis which seems to be the trend in recent literature on CEO turnover (e.g. Jenter et al., 2015; Gao, Harford & Li, 2017). We reason this with the criticism that some of the methods and results used in these classical papers on CEO turnover have received as of late. Fee, Hadlock, Huang, and Pierce (2017) did a thorough examination on the robustness of empirical models and findings regarding CEO turnover. In their paper, they provide evidence "...strongly suggesting that events that are labelled as voluntary are often, in fact, forced, and thus it can be misleading to separate these events from the others." (Fee et al., 2017). Regardless, given anonymized firms in the dataset, we are unable to determine the reason for replacement, whether dismissal, retirement or death. This implies that our results are likely to be downward biased.

4.2.1.2 Firm Survival

Concerning CEO turnover, we find it relevant to discuss the matter of firm survival. Several firms do not survive the complete time span in our dataset, which indicates that many firms go bankrupt during the sample period. However, we do not identify this as a CEO turnover. There certainly are arguments for identifying a bankruptcy as a CEO turnover, given that the CEO performed so poorly that the firm went bankrupt. On the other hand, there are several small entrepreneurial firms in Norway, and thus also in our sample, with owners who for several reasons could decide to shut down the firm and start a new one. Moreover, there could also be other reasons for why a firm is missing in certain periods of the dataset that we are not aware of. Hence, we did not identify bankruptcy as a CEO turnover, which again may bias our results to some extent.

4.2.2 Independent Variables

Return on Assets (ROA): Previous research found a strong link between CEO turnover and accounting-based performance (Murphy & Zimmerman, 1993). Moreover, prior studies on corporate governance commonly use one or two-year lagged ROA to measure the relationship between executive replacement and firm performance. In our case, we use one-year lagged ROA as our main performance measure as the process of firing a CEO in Norway is fairly quick. To check for robustness, we also included delta ROA between t-2 and t-1 as an independent variable to capture trend, which is elaborated on in Section 5.9.2. The mean reversion of accounting measures is accounted for by using control variables. Lagged ROA means that if a CEO turnover occurred in year t, ROA was measured in year t-1. This is consistent with prior research on CEO turnover (González et al., 2015; Chen et al., 2013). We define ROA as follows:

$$ROA_{it} = \frac{Earnings_{it}}{Total\ Assets_{it}}$$

Where “Earnings” is defines as:

$$Earnings_{it} = Net\ Income_{it} + Interest\ Expense_{it}$$

Profit dummy: A firm with a negative profit implies that the firm’s expenses exceeded its income, which could be a sign of financial distress. This could potentially lead to CEO replacement (Kaplan, 1994a). We therefore find it appropriate to include a profit dummy as an additional performance metric, similar to prior research (González et al., 2015; Kaplan, 1994a). The dichotomous profit variable takes the value of 1 if the firm obtains positive profits in year t and 0 otherwise. Similar to ROA, we lag the profit dummy by one year.

4.2.2.1 Stock Return versus ROA as a Measure of Performance

Previous studies on corporate governance (e.g. Kaplan, 1994a) argue that stakeholders and the board of directors should measure manager’s performance by using the firm’s stock prices. Accounting data on the other hand (e.g. ROA) arguably contains information that might be irrelevant when measuring the CEO’s performance (Chen et al., 2013; Engel, Hayes & Wang, 2003). However, the same may be true for stock prices, where for instance changes in the market discount rate is out of the managers control.

Several academic papers on CEO turnover and firm performance use the stock returns as a metric for firm performance (e.g. Jenter et al, 2015). One limitation with that is that stock prices are forward looking, so that in an efficient market, the stock prices should reflect the likelihood of a CEO turnover. This reduces the predictive power of firm performance on CEO turnover (Fee et al., 2017). A limitation of using accounting measures however is that it disregards non-financial value creation, such as brand name. Even large investments, which could lead to significant growth and income in later years, may result in large negative returns in the initial stages. Lastly, accounting measures are considered more predictable by nature than stock returns.

Since previous studies convey different arguments about whether accounting measure or stock returns give the best measure of managers' performance, it is not obvious which metric has more explanatory power (Milgrom & Roberts, 1992). In this thesis, we explore CEO turnovers in private firms, hence we evidently employ ROA as our performance measure.

4.2.3 Moderating Variable

Family firm dummy: To measure the moderating effect of being a family firm, we include a dichotomous variable that takes the value of 1 if the firm is considered a family firm and 0 otherwise (i.e. non-family firm). This way we can explore the difference in CEO turnover to performance sensitivity in family and non-family firms. To reiterate, we identify the firm as a family firm if the family has an ultimate ownership stake exceeding 50%, and non-family otherwise.

4.2.4 Control Variables

Firm size: Traditionally, firm size has been used as a control variable when examining the relationship between CEO turnover and firm performance. Larger firms usually have different attributes compared to smaller firms, and previous research have shown that there is a lower probability for CEO turnover in larger firms when comparing the two groups (Denis et al., 1997; Parrino, 1997). In this thesis, we use revenue as a proxy for firm size.

Firm age: As mentioned earlier, previous empirical studies have argued that the differences between family firms and non-family firms are shown with respect to firm age and size. There might also be differences within each group of firms. For instance, mature firms might employ different corporate governance strategies than younger firms and thus experience different firm performance. We identify the firm age by subtracting the founding year of the firm from year t. E.g., if the year is 2007 and the firm is founded in 1940, the firm age is 67.

CEO age: As mentioned earlier CEO turnover could also be a result of retirement, sickness, death or other reasons that are not related to governance issues (Messersmith et al., 2014). When the CEO is old, retirement is more likely, and retirement due to health or sickness is more likely the older the CEO gets (Chen et al., 2013). We determine the CEO age by manually subtracting the CEO birth year from year t. E.g., if the year is 2007 and the CEO's birth year is 1970, the CEO age is 37.

CEO tenure: Theories on corporate governance argue that the longer the managing CEO stays in his/her position in the firm the more powerful he/she becomes. As the managing CEO becomes more powerful over time, it becomes more difficult to fire him/her. Several academic papers have found that CEO turnover probability diminish when CEO tenure increases (González et al., 2015; Chen et al., 2013; Denis, Denis & Sarin, 1997). This is also the case in our sample (see Section 5.1 and Figure 3). Hence, we control for CEO tenure.

CEO ownership: As mentioned in Section 3.2, we remove all firms with a controlling CEO (i.e. CEO ownership greater than 50%). We further include the variable CEO ownership in our regression models, which consequently contains the CEO's ownership stake, varying from 0% to 50%. Including this variable will control for CEO power and potential entrenchment (Jenter et al., 2015; Dikolli 2014). Lastly, prior research finds that the negative relationship between CEO turnover and firm performance is weakened by higher CEO ownership (Brunello et al., 2003).

Family CEO dummy: Prior research indicates that CEO turnover is less likely if the CEO is a member of the controlling family (Visintin, Pittino & Minichilli, 2015; González et al. 2015; Rachpradit et al., 2012). To determine whether the relationship between CEO turnover and firm performance is weakened through the CEO being a relative to the owning family, we use a dichotomous control variable that takes the value of 1 if the CEO is related to the controlling family and 0 otherwise. We run regressions both including and excluding the family CEO dummy to show the distinct effects.

Number of firms in the region: Given that family firms may be more entailed to hire an insider (i.e. a family member) as an executive, there could be significant differences in the CEO candidate pool for family and non-family firms. To control for differences in the CEO candidate pool depth, we include a control variable on the number of family (non-family) firms in the given region that the family (non-family) firm operates in. The firms are categorized into 18 different regions representing the counties in Norway, if not categorized as “unknown” (if missing values) or “multiple” (if operating in multiple regions during the period). The region categorization is specified in Appendix 2.

Industry dummies: It is essential to measure the relative firm performance and CEO turnover relationship with respect to different industries. Firms operating in distinct industries naturally exhibit different characteristics and may pursue alternative corporate governance strategies. Considering family and non-family firms, it is well established that they tend to operate in different sectors and locations (Westhead et al., 1998, Berzins et al., 2018). Therefore, the more precise research should control for demographic differences. Dummies for industry will account for differences between the industries, which in turn will help us identify the real performance differences between the two groups of firms. The firms are labelled according to official industry classifications provided by Statistics Norway (SSB, 2019), and then consolidated into broader industry categories taking inspiration from Berzins et al. (2018). In 2008, Statistics Norway changed its industry code definitions taking effect from 2009. Hence, all industry classifications pre-2009 were adjusted accordingly to reflect the current classification. The industry categorization is specified in Appendix 3.

Time period dummies: To control for abnormal economy-wide shocks, we include a set of time period dummy variables. We include time period dummies for each year of our sample period, i.e. from 2000-2017. Thus, we can consistently interpret performance variables relatively to the overall state of the economy.

4.2.5 Instrumental Variable

Instrumental variables are used when there exist endogeneity issues, which can arise from omitted variables, reverse causality and measurement error. In this thesis, we compare two groups of firms, namely family and non-family firms. In such cases, there could be concern that some underlying difference is the true cause of the results (Gao et al., 2017). Staying a family firm is a choice, as similar to going public, a family can at any time sell its ownership stake to outsiders. Hence, we argue that membership in each group is endogenous. Consequently, we believe it is unlikely that reverse-causality is present. We consider omitted variables on the other hand more likely. This means that there are potential benefits to identify and include an instrumental variable for our regressions. A potentially beneficial instrumental variable could be the gender of the departing CEO's firstborn child, first introduced by Bennedsen et al. (2007). However, our dataset does not provide us with sufficient information to manually construct such instrumental variable. However, we do in theory include an instrumental variable in testing the effect of exogenous shocks on CEO turnover (H4), which is elaborated on in Section 5.7.3. In this case, our instrumental variable is industry return on assets (IROA). The rationale behind this instrumental variable is that IROA should be correlated with performance of a firm operating in that industry, while it should not be correlated with an individual CEO's ability. This is consistent with the definition of a proper instrumental variable.

4.3 Empirical Models

In this section, we begin with elaborating on panel data regressions (4.3.1) followed by a discussion on random versus fixed effects model (4.3.2). Next, we present the empirical models employed in this thesis, starting with the binary response model (4.3.3), which is used for the majority of our hypothesis (H1, H2, H5). Next, we discuss the Propensity Score Matching model (4.3.4), which is used to create a matched sample of family and non-family firms. The linear generalized least squares (GLS) regression is employed for H3, while a two-stage regression model is used for H4, discussed in Section 4.3.5 and 4.3.6 respectively.

4.3.1 Panel Data

Panel data models combines both cross-sectional and time-series data, where the exact cross-sectional unit (e.g. a specific family firm) is observed over time. Structured panel data can also help measuring dissimilar variables for units over a given time period, which allows us to analyse a comprehensive dataset (Brooks, 2014). Moreover, panel data regressions address endogeneity coming from unobserved but stable differences in firm characteristics. According to Baltagi (2005) there are also several other advantages of using panel data:

- Panel data take a clear account of unit-specific heterogeneity.
- Since panel data combines the data in two dimensions, we obtain more data flexibility, lower collinearity risk between variables and more degrees of freedom.
- Panel data makes it easier to examine the dynamics of change and enable us to study more complex models easier.

There are two types of panel data, balanced and unbalanced. In balanced panel data, all the units have the same number of observations. This is not the case in our sample data as we have firms that for instance survive a time horizon of 3 years, whereas others survive for 17 years. Our dataset also contains several missing values. Hence, our panel data is considered unbalanced. Even though balanced panel data is ideal, most software packages such as Stata is able to handle both.

4.3.2 Fixed versus Random Effects

It is critical to apply an appropriate effect model that fits to our panel data sample, as choosing an unsuitable effect model can bias our results. There are two different effect models that are used when estimating panel data regressions, namely the fixed effect model and the random effect model. Both models have an assignment to allocate endogeneity problems (Brooks, 2014). However, the main difference between the fixed effect and the random effect model is that the former is constant across units (e.g. firms), while the latter fluctuate. Moreover, in a fixed effect model, differences among units are examined in intercepts, whereas in random effect model, differences among units are examined in their specified errors. In random effect model the intercept of independent variables is constant across units.

The choice of the appropriate model depends on the data sample. In our empirical models, we include industry and year fixed effects as specified in Section 4.2.4. Thus, we find it appropriate to use regression models with random effects. However, to provide additional support for our choice of effects, we conduct a Hausman test. The Hausman test examines the similarity between the random effect and fixed effect coefficients. Under the null hypothesis, the random effect model is appropriate. We fail to reject the null hypothesis (Appendix 4) and conclude that the random effect model is appropriate in our case.

We will not give a comprehensive explanation on the technics and practices of the Hausman test. If there are further interest in the model, the articles on the subject by Hausman (1978) and Clark and Linzer (2012) are recommended.

4.3.3 Binary Response Model

Following prior work on CEO turnover sensitivity to firm performance, we will estimate CEO turnover's sensitivity to performance by utilizing binary response models. CEO turnover will be our dependent variable which will equal 1 if the CEO is replaced in year t and 0 otherwise. Consequently, a linear regression model is inappropriate (Brooks, 2014). The binary response model is employed for hypothesis 1, 2, 4 and 5 utilizing regression model 1A-B and 2A-B, 3A-C, 5B, and 6 respectively as specified in Chapter 5.7.

4.3.3.1 Logistic Regression Model

The logistic regression model is used to analyse the relationship between a categorical dependent variable that has only two values and one or several explanatory variables (Brooks 2014). Moreover, the logistic regression model fits the data to a logit function, which in turn predicts the probability of an event occurring. The logistic regression model is the cumulative logistic probability distribution function given any random variable $\mathrm{w_i}$ (Brooks, 2014). Hence,

$$\mathrm{F(w_i)} = \frac{e^{\mathrm{w_i}}}{(1+e^{\mathrm{w_i}})} = \frac{1}{1+e^{-\mathrm{w_i}}}$$

$\mathrm{F(w_i)}$ can be interpreted as a probability and takes values between 0 and 1 based on $\mathrm{w_i}$. Hence, the estimated logistic model is as follows:

$$\mathrm{p_i} = \frac{1}{1 + e^{-(\beta_1+\beta_2 X_{2i}+\cdots+\beta_k X_{ki}+u_i)}}$$

We apply the logistic regression model on panel data by using the statistical software program, Stata. The software provides odds ratios and standard errors for each explanatory variable. Subsequently, we estimate the marginal effects, which measure the instant effect of a change in a specific explanatory variable on the predicted probability of the dependent variable, keeping all other covariates fixed. The *mfx* function in Stata provides the marginal effect of each explanatory variable.

4.3.4 Propensity Score Matching Model

Matching models have been progressively used in research. This is because of their ability to compare firms with similar properties to see the isolated effect of being treated. Hence, the focus of matching models is to estimate the effect of treatment on the data observed (Kai & Prabhala, 2007). Shortly explained, matching models compare two groups, the treatment group that undergo a treatment and the control group that does not.

In our paper, we utilize the Propensity Score Matching (PSM) model, which adds robustness to our analysis. The PSM model allows us to match comparable firms based on their observed properties, like for instance firm size, industry, region, etc. More specifically, we utilize the nearest neighbour matching algorithm without replacement, which match the firms with the closest propensity scores and only allow each member to be used once. Following the matching, we can measure the effect of the treatment by calculating the average difference in result between the treated firm and the non-treated firm (Bryson, Dorsett, & Purdon, 2002).

The most difficult challenge when using PSM method is to specify the model specification that comply with the balancing properties. For instance, one issue of using too many predictors is that we reduce our chance of finding matches between the treatment and control groups. To solve this issue, we use the propensity score as introduced by Rosenbaum and Rubin (1983). Propensity score is defined as the conditional probability of a unit that is assigned to a specific treatment given a vector of observed predictors. Thus, this allows us to match more firms with comparable propensity score, even if they do not share the same properties, but rather the combined value of the properties.

However, there is still the possibility that some properties in the control group does not have a comparable propensity score in the treatment group (Bryson et al., 2002). With the nearest neighbour matching algorithm, even though the firm in the control group is matched with the closest firm in the treatment group, they still might be dissimilar in absolute terms. We try to mitigate this problem by incorporating several matching variables as specified in Section 5.7.1.1.

To conclude, there are no clear path to specify the right model and there exists both reasons for and against incorporating the whole set of properties (covariates). Thus, it is up to us researchers to find an economic reasonable specification of the model.

4.3.5 Linear Regression Model using Generalized Least Squares

Because of the composite error term in the random effect model, OLS method is unsuitable. Instead, we apply the Generalized Least Square (GLS) method in our linear regression. There are several ways of estimating panel data using random effect model. However, according to Swamy and Arora (1972) all GLS estimators are asymptotically efficient when T and N are large, which indeed is the case with our large sample. We therefore employ the linear regression model with the default GLS method in Stata.

The linear regression with random effect is specified as follows:

$$Y_{it} = \alpha + X_{it}'\beta + \omega_{it} \qquad \text{where} \quad \omega_{it} = u_i + v_{it}$$

Hence, in GLS, the random effect model exploits the serial correlation in the aforementioned composite error ($\omega_{it} = u_i + v_{it}$). Moreover, $X_{it}'\beta$ is a vector of explanatory variables with a vector of regression coefficients (β) to be estimated.

4.3.6 Two-Stage Regression Model

Jenter et al. (2015) mention that previous research mainly tests for weak-form relative performance evaluation when examining CEO turnover sensitivity to performance. The weak-form estimation holds when there is a negative relationship between the probability of CEO turnover and firm performance, and a positive relationship between CEO turnover and the performance of the peer group. A more robust estimation would test for strong-form performance evaluation, where the board of directors take into account all relevant information only. Similar to the approach used by Jenter et al. (2015), we apply the two-stage regression model to test whether the board of directors filter out exogenous shocks in their CEO turnover decision making (i.e. strong-form performance evaluation).

Fundamentally, given effective monitoring, the board of directors should be able to filter out exogenous shocks such as poor industry-wide performance in their CEO replacement decision. This is the core of strong-form performance evaluation. The two-stage approach can be viewed as an instrumental variable estimation, where the peer group performance (e.g. industry returns) is used as an instrumental variable for firm performance. The results from the two stages regression model provide an explanation for whether CEO turnover is affected by exogenous shocks.

In our case, the two-stage regression model involves a linear regression in the first stage and a logistic regression model in the second stage. The model's specifications are explained in Section 5.7.3.

4.4 Validity

Validity refers to whether the measurement applied in our study measures what it is supposed to (Saunders et al, 2009). We apply both different models (e.g. probit model) and alternative performance measures (e.g. delta ROA) for robustness check in Section 5.9. These alternative measures provide similar results, hence improving the validity of our study. Moreover, we utilize propensity score matching to ensure we are not comparing apples with oranges, and an instrumental variable approach which deal with potential omitted variable bias in Section 5.7.1.1 and 5.7.3 respectively. Lastly, the methods we apply are based on previous research on corporate governance. Therefore, we argue that our measure of CEO turnover's sensitivity to firm performance is valid.

Reliability refers to whether the measure of our concept is consistent (Bryman et al., 2015). Our dataset on Norwegian private firms is extracted from CCGR, which is considered a reliable source. We further describe the empirical method in a careful and structured manner to make it uncomplicated for future researchers to replicate our model. Hence, we argue that our findings are reliable.

External validity regards to what extent our results can be generalized in other contexts, and whether our sample can be representative for the population (Bryman et al., 2015). Arguably, our study can be generalized to all private firms in Norway due to our large sample. However, we recognize that our sample constitutes firms with distinct characteristics that may be specific only to Norway, weakening the level of generalization across borders.

5. Empirical Results & Analysis

In this chapter, we start with discussing the descriptive statistics (5.1). Next, we elaborate on critical matters such as normality (5.2), endogeneity (5.3), heteroscedasticity (5.4), autocorrelation (5.5), and multicollinearity (5.6). The last sections involve the regression models (5.7), analyses of the results (5.8), and finally robustness checks (5.9).

5.1 Descriptive Statistics

After applying the necessary filtering on the data extracted from CCGR, our final sample consists of 182 973 non-family firm observations and 163 758 family firm observations, giving a total of 346 731 firm-year observations. The time horizon we are analysing is 18 years, from year 2000 to year 2017.

The annual frequency of CEO turnover for family and non-family firms is presented in Table 1. Because of several missing values for CEO turnover, we end up with 245 806 firm-year observations, divided in 150 738 and 95 068 for non-family and family firms respectively. In Table 1, we see that the total number of CEO turnovers over the sample period are 5 304 in non-family firms and 1 760 in family firms. Hence, the rate of CEO turnovers is 3,5% and 1,85% for non-family and family firms respectively. This is a significant difference and shows that family firms are in general much less likely to fire its CEO compared to non-family firms. The aforementioned result provides support for continuity and longer-term perspective in family firms, hence advocating the stewardship perspective in family firms.

Our sample indicates that there was no obvious spike in CEO turnover rates during the financial crisis (i.e. 2007-2008). One explanation could be that the financial crisis did not have as big of an impact on Norway compared to countries such as USA, Japan and most of Europe (OECD Statistics, 2019). Another explanation could be effective monitoring, meaning that the board does not dismiss the CEO based on exogenous factors that the CEO has no control over.

TABLE 1 - CEO Turnover Frequency over Time

Table 1 portrays the yearly frequency of CEO turnover in family and non-family firms. Our sample constitutes a total of 245 806 observations with 150 738 non-family firms and 95 068 family-firms. The table was constructed after filtering our data (see Chapter 3) and shows the exact sample used in our empirical analysis.

	Panel A: Non-family firms			Panel B: Family firms		
Year	Number of Firms	Number of CEO Turnovers	% of Firms with CEO Turnover	Number of Firms	Number of CEO Turnovers	% of Firms with CEO Turnover
2000	5379	0	0,00 %	4554	0	0,00 %
2001	6026	342	5,68 %	4900	183	3,73 %
2002	6242	312	5,00 %	4911	151	3,07 %
2003	6473	193	2,98 %	4830	103	2,13 %
2004	6546	323	4,93 %	4755	100	2,10 %
2005	7028	199	2,83 %	4847	79	1,63 %
2006	6908	360	5,21 %	4074	82	2,01 %
2007	7716	303	3,93 %	5083	104	2,05 %
2008	7800	290	3,72 %	5109	114	2,23 %
2009	7752	359	4,63 %	5041	115	2,28 %
2010	8133	281	3,46 %	5220	77	1,48 %
2011	8410	317	3,77 %	5277	109	2,07 %
2012	9515	403	4,24 %	5616	100	1,78 %
2013	10706	430	4,02 %	6239	104	1,67 %
2014	11588	451	3,89 %	6571	125	1,90 %
2015	12842	25	0,19 %	6921	2	0,03 %
2016	12082	716	5,93 %	6500	212	3,26 %
2017	9592	0	0,00 %	4620	0	0,00 %
Total	150738	5304	3,52 %	95068	1760	1,85 %

We also notice that there are large differences in CEO turnover rates across both regions (Table 2) and industries (Table 3). Interestingly, the two regions Akershus and Buskerud have the highest CEO turnover rates (excluding firms operating in multiple regions) for both family and non-family firms.

TABLE 2 - CEO Turnover across Regions

Table 3 portrays the frequency of CEO turnover in family and non-family firms across regions. The abbreviations for regions can be found in Appendix 2.

	Panel A: Non-family firms				Panel B: Family firms			
Location	Number of Observations	Number of Distinct Firms	Number of CEO Turnovers	% of Firms with CEO Turnover	Number of Observations	Number of Distinct Firms	Number of CEO Turnovers	% of Firms with CEO Turnover
OSL	35239	6597	1078	3,06 %	23678	5765	228	0,96 %
AKR	12032	2175	442	3,67 %	7524	1684	87	1,16 %
ØFO	29855	5166	1078	3,61 %	18551	3897	182	0,98 %
HED	12684	2462	381	3,00 %	8702	2509	74	0,85 %
OPL	0	0	0	N/A	0	0	0	N/A
BUS	20121	4275	804	4,00 %	9674	3432	123	1,27 %
VFO	0	0	0	N/A	0	0	0	N/A
TEL	0	0	0	N/A	0	0	0	N/A
ROG	5416	948	198	3,66 %	3256	717	32	0,98 %
VAG	0	0	0	N/A	0	0	0	N/A
AAG	0	0	0	N/A	0	0	0	N/A
HRD	5126	950	182	3,55 %	3259	725	37	1,14 %
SFJ	0	0	0	N/A	0	0	0	N/A
MRO	7241	1375	243	3,36 %	5354	1176	49	0,92 %
TRL	6524	1214	202	3,10 %	4433	1113	48	1,08 %
NRL	4323	813	142	3,28 %	3601	731	35	0,97 %
TRO	3338	613	101	3,03 %	2108	507	18	0,85 %
FNM	0	0	0	N/A	0	0	0	N/A
UNK	16	7	0	0,00 %	5	2	0	0,00 %
MUL	8823	1557	453	5,13 %	4923	1354	847	17,20 %
Total	150738	28152	5304	3,52 %	95068	23612	1760	1,85 %

Regarding industries (Table 3), non-family firms operating in the arts, entertainment and recreation industry (abbreviated CUL) have the highest CEO turnover rate of 4,54% for non-family firms (excluding firms operating in multiple industries). In contrast, family firms operating in the manufacturing industry experience the highest CEO turnover rates of 2,21% for family firms.

TABLE 3 - CEO Turnover across Industries

Table 2 portrays the frequency of CEO turnover in family and non-family firms across industries. Abbreviations for each industry can be found in Appendix 3.

	Panel A: Non-family firms				Panel B: Family firms			
Industry	Number of Observations	Number of Distinct Firms	Number of CEO Turnovers	% of Observations with CEO Turnover	Number of Observations	Number of Distinct Firms	Number of CEO Turnovers	% of Observations with CEO Turnover
AFM	3191	746	110	3,45 %	2770	810	46	1,66 %
MFG	8230	1474	336	4,08 %	5440	1119	120	2,21 %
NRG	1488	244	48	3,23 %	197	51	3	1,52 %
ICR	37311	6866	957	2,56 %	21543	5214	376	1,75 %
TRD	4426	917	170	3,84 %	5198	1074	88	1,69 %
LOG	24745	4787	734	2,97 %	20637	4756	386	1,87 %
SVC	42620	8426	1667	3,91 %	19149	5887	328	1,71 %
EHS	7716	1394	322	4,17 %	3898	1070	72	1,85 %
CUL	2094	570	95	4,54 %	781	274	8	1,02 %
UNK	140	68	4	2,86 %	123	85	1	0,81 %
MUL	18777	2660	861	4,59 %	15332	3272	332	2,17 %
Total	150738	28152	5304	3,52 %	95068	23612	1760	1,85 %

Exploring the movements in ROA around CEO turnover could indicate any relationship between the two. In Figure 1, we plotted ROA around the CEO turnover (t=0). We see a clear downward trend in the two years prior to CEO turnover. However, it seems from Figure 1 that replacing the CEO does not induce significant performance improvement. Rather, it seems like the negative trend in ROA prior to the turnover continues following the replacement. Yet, this may be due to the short post-turnover period of 2 years. According to Gabarro (1987), CEOs use 2,5 to 4 years to establish authority in a firm. Moreover, we do see improvement in family firms from year 1 to 2 in Figure 1 which may imply that the CEO has finally settled and is reaping firm performance improvements.

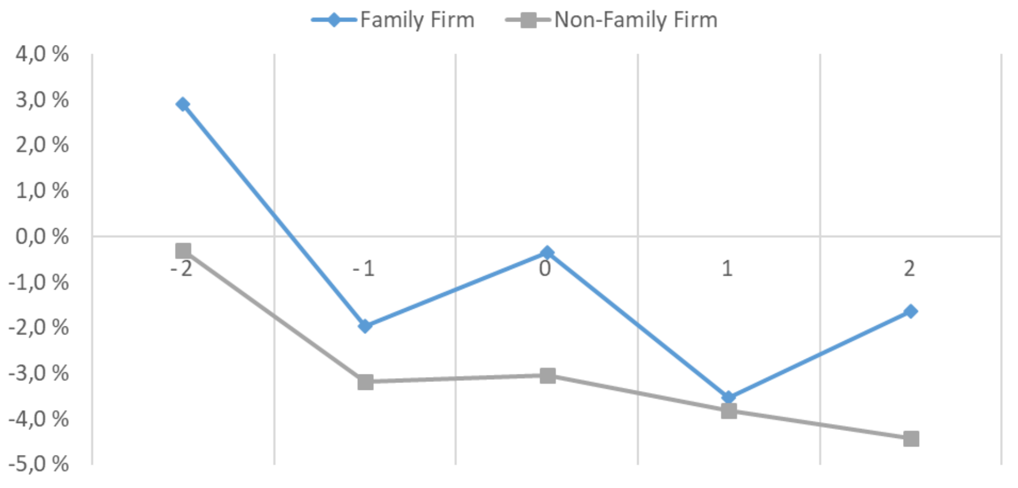

FIGURE 1 - ROA AROUND CEO TURNOVER (T=0)

Moreover, we plotted family ultimate ownership stake around CEO turnover (t=0). The family ultimate ownership remains relatively stable around the turnover, implying that most of the turnovers are irrespective to any takeovers or major changes in corporate governance strategy from a new owner (Figure 2).

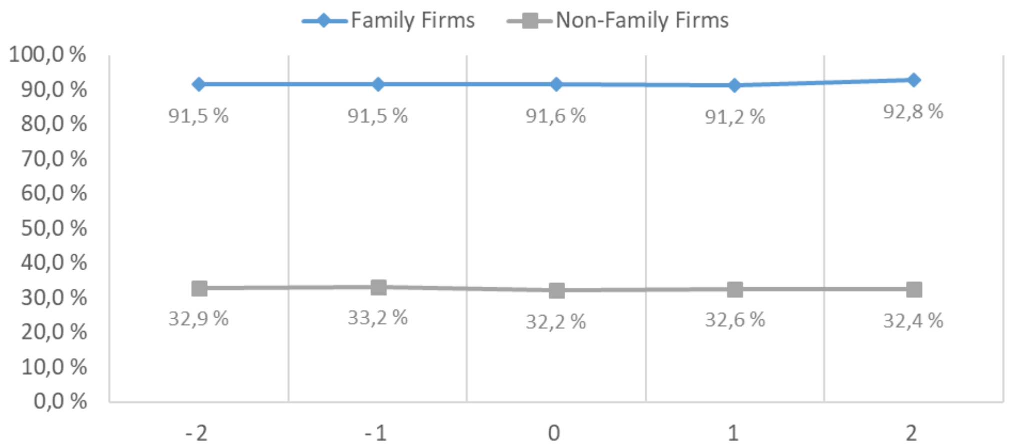

FIGURE 2 - FAMILY ULTIMATE OWNERSHIP AROUND TURNOVER (T=0)

The descriptive statistics is presented in Table 4. Panel A shows descriptive statistics for the full sample including observations with missing values on family ultimate ownership. Thus, the total number of observations in the full sample amounts to 511 922, whereas the total number of observations including ultimate family ownership data amounts to 346 731 observations. The former gets filtered out by Stata in our regressions, hence the latter is the sample used in our empirical analysis. Panel B and C show descriptive statistics for non-family and family firms respectively. Moreover, to assess whether there is a significant difference in firm and CEO characteristics between family and non-family firms, we have performed a t-test with unequal variances to test for a difference in means, and a Wilcoxon rank sum test to examine a difference in medians (Appendix 5 and Appendix 6 respectively). One advantage with the Wilcoxon rank sum test is that we do not need to assume that the population is normally distributed for Wilcoxon to be applicable, hence it is considered robust.

Concerning CEO characteristics, CEOs in family firms are on average older and have a longer tenure than CEOs in non-family firms (Table 4, Panel B and C). Our findings about CEO tenure is consistent with former research (e.g. Gallo, 1995), which shows that CEOs and the existing management teams in family firms have notably longer tenures than managers in non-family firms. In our sample, we can also clearly see that the rate of CEO turnover decreases with the years of tenure, especially in the early years (Figure 3). Moreover, CEO ownership concentration is higher in family firms than in non-family firms, which is consistent with Berzins et al. (2018). CEO age, tenure and ownership are all significantly different for family and non-family firms at the 99% level for both the t-test and the Wilcoxon test (Table 4, Panel D).

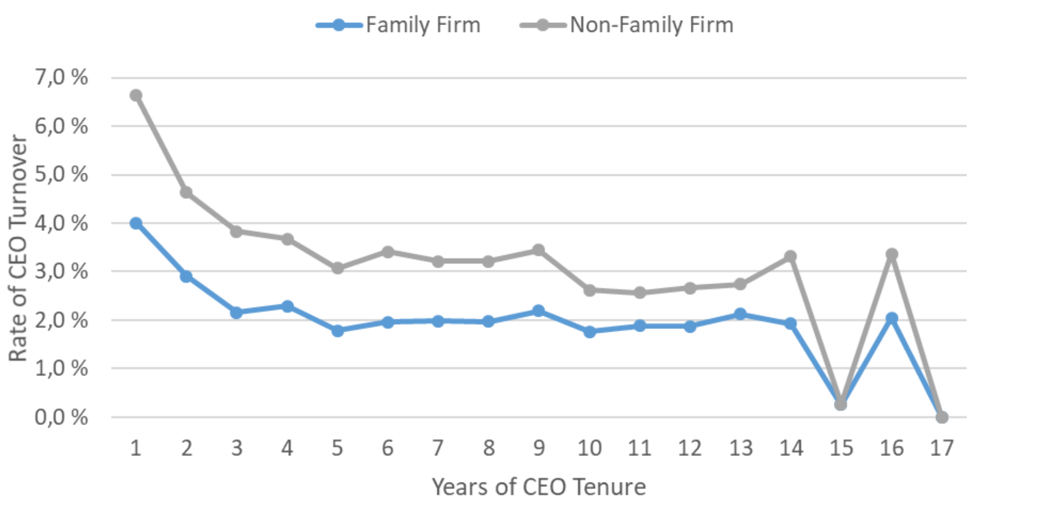

FIGURE 3 - THE RELATIONSHIP BETWEEN TENURE AND CEO TURNOVER

As for board size, family firms have smaller boards than non-family firms on average. The mean (median) board size for non-family firms is 2,9 (3), while for family firms it is only 1,8 (1). This may be related to the family firms being smaller in general. Moreover, family firms are on average older than non-family firms. Both these variables are significantly different for family and non-family firms at the 99% level for both the t-test and the Wilcoxon test (Table 4, Panel D).

For ROA, the independent variable in our main regression models, we see a wide range of values from the minimum ratio of -1,71 to the maximum of 1,23 (Table 3, Panel A). Moreover, the skewness and kurtosis are -1,31 and 9,63 respectively. This means that the ROA distribution in our sample is leptokurtic and negatively skewed and is thus not normally distributed. Note that the ROA reported is winsorized at the 1^{st} and 99^{th} percentile to remove outliers. However, non-normality should not be an issue for our regression models (see Section 5.2).

To compare differences in firm size, we use revenue as a proxy. In Panel B and C, we show that non-family firms are on average larger than family firms. The mean (median) revenue is NOK 5 486 257 (NOK 1 588 304) for non-family firms and NOK 3 242 473 (NOK 899 476) for family firms. The difference in revenue mean (median) is significant at the 99% level, providing evidence of firm size differences between family and non-family firms. Total assets mean (median) are also significantly higher for non-family firms compared to family firms, which confirms that on average non-family firms are bigger than family firms. On the other hand, the mean (median) net income is NOK 182 692 (NOK 32 267) for non-family firms and NOK 270 935 (NOK 36 519) for family firms. Hence, family firms have in fact higher net income on average. The differences are also significant on a 99% level, for both mean and median. The latter findings are consistent with Berzins et al. (2018) who find that Norwegian family firms are more profitable than non-family firms.

However, despite the statistically significant differences in firm characteristics between family and non-family firms, the two groups of firms are fairly comparable. This is supported by the propensity score matching conducted in Section 5.8.1.3.

TABLE 4 - Descriptive Statistics

Table 4 portrays the descriptive statistics for our sample. Any number followed by † are in millions

Panel A: Full Sample

Variables	N	Minimum	Maximum	Mean	Std. Dev.	Skewness	Kurtosis
CEO Turnover	363 092	0	1	0,034	0,181	5,150	27,526
ROA	506 886	-1,710	1,230	0,028	0,425	-1,308	9,627
Profit dummy	511 922	0	1	0,621	0,485	-0,501	1,251
Revenues	511 922	-258†	21300†	10,8†	161†	71	6 496
Net income	511 922	-7150†	14700†	608 721	36,4†	153	62 274
Operating income	511 922	-7240†	16200†	1,461†	85,9†	103	14 717
Other interest expenses	511 922	-1530†	36,1†	-134 769	4,748†	-237	68 745
CEO age	363 092	17	98	48,147	11,202	0,143	2,667
CEO tenure	363 092	0	17	3,984	3,869	1,212	3,916
CEO ownership	184 765	0	50	39,383	12,898	-0,929	2,810
Family CEO	354 814	0	1	0,426	0,495	0,297	1,088
CEO gender	363 075	0	1	0,779	0,415	-1,346	2,812
Total assets	511 922	0	56200†	14,7†	364†	80	8 268
Board size	465 677	1	15	2,597	1,491	1,020	4,255
Number of family members on board	354 814	0	7	1,207	0,832	1,429	6,449
Firm age	488 638	0	345	10,901	13,192	3,731	31,115
Number of employees	376 849	0	3 288	7,308	33,274	36	2 076
Number of firms in the industry	346 731	3	8 426	4 774	2 440	-0,249	2,143
Number of firms in the region	346 731	2	6 597	3 533	2 006	0,089	1,602

	Panel B: Non-Family Firms						Panel C: Family Firms						Panel D: Test of Difference	
	N	Minimum	Maximum	Mean	Median	Std. Dev.	N	Minimum	Maximum	Mean	Median	Std. Dev.	t-test	Wilcoxon test
Variables	1	2	3	4	5	6	7	8	9	10	11	12	(4) - (10)	(5) - (11)
CEO Turnover	156 042	0	1	0,034	0,000	0,181	96 828	0	1	0,018	0,000	0,134	0,016***	0,000***
ROA	182 276	-1,71	1,23	0,007	0,053	0,364	162 728	-1,710	1,230	0,020	0,055	0,370	-0,014***	-0,002***
Profit dummy	182 973	0	1	0,621	1,000	0,485	163 758	0	1	0,633	1,000	0,482	-0,013***	0,000***
Revenues	182 973	-3,033†	1870†	5,486†	1,588†	20,3†	163 758	-6,572†	211†	3,242†	899 476	9,986†	2 243 784***	688 828***
Net Income	182 973	-7150†	690†	182 692	32 267	17,1†	163 758	-324†	157†	270 935	36 519	5,38†	-88 244**	-4 252***
Operating income	182 973	-7240†	371†	328 501	64 253	17,4†	163 758	-326†	689†	274 687	50 034	2,961†	53 814*	14 219***
Other interest expenses	182 973	-86,3†	738 642	-75 271	-3 916	713 346	163 758	-46,5†	204 000	-44 781	-2 799	203 272	-30 490***	-1 117***
CEO age	156 042	18	96	46,869	47,000	10,761	96 828	17	98	48,875	48,000	12,362	-2,006***	-1,000***
CEO tenure	156 042	0	17	3,969	3,000	3,884	96 828	0	17	4,325	3,000	4,096	-0,356***	0,000***
CEO ownership	116 806	0	50	39,194	50,000	12,946	67 165	0	50	40,066	49,000	12,420	-0,872***	1,000***
Family CEO	182 973	0	1	0,367	0,000	0,482	163 758	0	1	0,503	1,000	0,500	-0,136***	-1,000***
CEO gender	156 041	0	1	0,806	1,000	0,396	96 819	0	1	0,723	1,000	0,448	0,083***	0,000***
Total assets	182 973	0	5350†	4,615†	1,222†	34,6†	163 758	0	303†	3,492†	1,131†	19†	1 122 786***	90 688***
Board size	180 112	1	15	2,934	3,000	1,359	157 302	1	8	1,859	1,000	1,056	1,075***	2,000***
Number of family members on board	182 973	0	6	0,906	1,000	0,508	163 758	0	7	1,571	1,000	0,972	-0,665***	0,000***
Firm age	173 961	0	212	9,248	6,000	11,954	157 428	0	345	10,540	7,000	10,990	-1,292***	-1,000***
Number of employees	134 400	0	644	6,011	3,000	10,374	123 966	0	373	4,274	2,000	7,426	1,737***	1,000***
Number of firms in the industry	182 973	68	8 426	5 389	6 866	2 735	163 758	3	5 887	4 086	4 756	1 829	1 303***	2 110***
Number of firms in the region	182 973	7	6 597	3 834	4 275	2 120	163 758	2	5 765	3 197	3 432	1 813	637***	843***

5.2 Normality

According to Brooks (2014), the Central Limit Theorem states that the validity of our regressions should not be influenced by non-normality given our large sample size. Nonetheless, the presence of outliers may drive the significance of our results and lead to incorrect conclusions. Hence, we apply the natural logarithm to certain variables to account for extreme values. More specifically, we take the natural logarithm of revenues, CEO tenure and firm age to smooth outliers and increase the validity of our data. As part of our data filtering in Section 3.2, we removed negative and zero values for revenue, thus taking the natural logarithm is valid. In contrast, we did not take the natural logarithm of the ROA variable because of the occurrence of negative and zero values, which consequently would lead to several missing values.

To check for potential outliers for our main independent variable, ROA, we generate a histogram. Depicted in Figure 4, we see that ROA prior to winsorization includes extreme outliers spanning from -10 328 to 5 348. Thus, we winsorize the ROA variable at the 1st and 99th percentile to adjust for such extreme outliers. This approach is used in several academic papers on the same research topic as a treatment of outliers (e.g. Chen et al., 2013; Gao et al., 2017). By winsorizing the data, we transform the values that are greater than the 99th percentile to equal the 99th percentile value, and values that are smaller than the 1st percentile to equal the 1st percentile value. Thus, we do not remove extreme outliers, but rather transform them, maintaining our large sample. Ghosh and Vogt (2012) argue that winsorization attains robust statistics. The result after winsorizing ROA at the 1st and 99th percentile is depicted in Figure 5. This histogram, without extreme outliers, displays a much more compelling distribution compared to the one prior to winsorization (Figure 4).

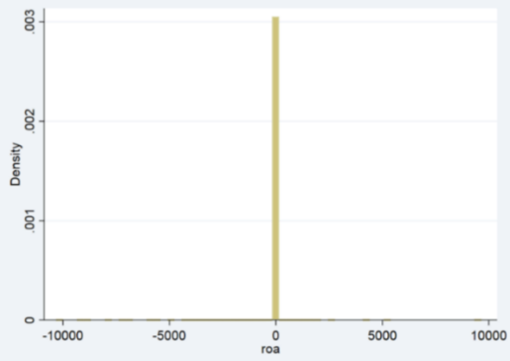

FIGURE 4 – ROA BEFORE WINSORIZATION

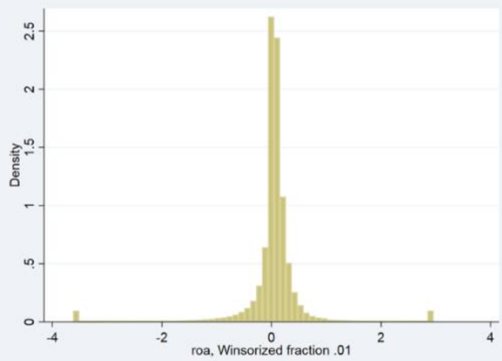

FIGURE 5 – ROA AFTER WINSORIZATION AT 1ST AND 99TH PERCENTILE

5.3 Endogeneity

Endogeneity can be seen as a situation where one incorrectly identifies a causal link between factor X and factor Y when the observed link is actually caused by another factor Z that effects both factor X and factor Y (Brooks, 2014). Hence, endogeneity occurs when one or several predictors used in the model is correlated with the error term. This will result in biased estimates, where the mean of the estimated coefficients that suffer from endogeneity will not converge to their true values after repeating the process multiple times. Moreover, there are several potential issues in the model estimation that may lead to endogeneity problems. The main causes of endogeneity are omitted variables, measurement error, and simultaneity. Omitted variable bias occur when the variable(s) that explain the true effect of the change in the dependent variable is not included in the regression model (Brooks, 2014). Measurement error occurs when the error term is correlated with the independent variable, which in turn makes it difficult to measure whether X cause the changes in Y or there are other factors that might be the actual cause of Y. Simultaneity occurs when the predictor is jointly determined with the dependent variable, such that X causes Y and at the same time Y causes X as well. This makes X and Y a function of each other with a causality link that works both ways (Brooks, 2014).

To mitigate the omitted variable problem, we make sure to include relevant variables in our regression. As for measurement error, we try to reduce the problem by including control variables such as firm size and industry dummies. The fact that we use lagged values for our performance measures reduce simultaneity. However, it does not completely remove the possibility of double causality. For instance, there might be reverse causality between firm performance and CEO turnover. Poor firm performance might increase the probability of CEO turnover, but on the other hand, CEOs might leave firms with poor performance to for instance maintain their reputation (Fich and Shivdasani, 2007).

Conveniently, panel regressions address endogeneity coming from unobserved but stable differences in firm characteristics. However, since endogeneity comes in different forms, it is worthwhile to also consider the issue of selection bias.

5.3.1 Selection Bias

Selection bias is an issue which could lead to omitted variables and thus endogeneity. A common assumption in statistics is that the sample must be representative of the underlying population to conclude internal and external validity. Any systematic differences between our final sample and the population could indicate selection bias (Shringarpure & Xing, 2014). As mentioned earlier, our data sample is extracted from CCGR and represent the population of Norwegian private firms. This implies that our raw data should not suffer from selection bias. However, the filters applied to the original data in Section 3.2 may induce selection bias issues (i.e. the firms remaining might not have been chosen randomly from the population). Hence, our final sample may be exposed to selection bias. Unfortunately, the tests for selection bias on Stata are not eligible for non-linear panel data. However, we deal with potential selection bias in other sophisticated ways in this thesis. For instance, we utilize propensity score matching as an additional robustness for regression 3A-C (Section 5.7.1.1), and an instrumental variable approach for regression 5A-B (Section 5.7.3). These are both two-stage regression models that in its own way help control for potential selection bias.

5.4 Heteroscedasticity

Heteroscedasticity, or the absence of homoscedasticity, refers to a systematic change in the residuals' scatter over the range of estimated values (Brooks, 2014). Hence, the assumption of residuals' constant variance is violated in the presence of heteroscedasticity. Moreover, the presence of heteroscedasticity can violate the statistical test of significance in the regression model, which in turn makes us draw wrong conclusions (Brooks, 2014). To avoid heteroscedasticity, we rescale the data by taking the natural logarithm of variables such as revenues, CEO tenure and firm age. This way, the residuals' variance becomes more constant. Moreover, we apply heteroskedastic-robust standard errors in our regression models to account for potential heteroscedasticity in the sample. This approach is in line with other academic papers on CEO turnover (e.g. González et al., 2015; Chen, et al., 2013; Gao, et al., 2017).

5.5 Autocorrelation

Autocorrelation is an issue in econometrics which could lead to smaller standard errors and an inflated R-squared (Wooldridge, 2002). Autocorrelation is mainly an issue in panel data when there is a long time series. Given our dataset constitutes a time horizon of 18 years, we test for autocorrelation. We apply the Wald test, where the null hypothesis states that there is no autocorrelation. The results imply autocorrelation in our data as we reject the null hypothesis of no autocorrelation (Appendix 7). Conveniently, applying robust standard errors to our regressions help us mitigate the problem of autocorrelation. In fact, the robust standard errors deal with both suspected heteroskedasticity and within-panel autocorrelation.

5.6 Multicollinearity

It is essential to check if there exists collinearity between the independent variables that are applied in our regression models. Multicollinearity is an issue when predictor variables move systematically together (Hill, Griffiths, & Lim, 2008). Hence, the presence of strong multicollinearity can increase the variance of the estimated coefficients and make them sensitive to small changes in our regression model. To check for potential multicollinearity, we construct a correlation matrix (Appendix 8). We identify any correlation above 0,75 or below –0,75 as an indication of multicollinearity (Sweet & Grace-Martin, 2003). Analysing each variable's correlation with each other variable, we find no signs of multicollinearity between the predictors used in our regressions. The highest correlation is between the variables CEO tenure and CEO age, and amounts to 0,692 (Appendix 8), which is still within the acceptable range.

5.7 Regression Models

In this section, we will provide the specification for our regressions, defined for each hypothesis. To reiterate, H1 and H2 concern the relationship between CEO turnover and firm performance and is covered in Section 5.7.1. Indicators of whether the CEO turnover decision was a result of effective monitoring, such as post-turnover performance (H3), exogenous shocks independency (H4), and outside CEO successor to prior firm performance relationship (H5) are covered in Section 5.7.2, 5.7.3, and 5.7.4 respectively.

5.7.1 Logistic Regression on CEO Turnover

For hypothesis H1 and H2, we employ the non-linear logistic regression with random effects and heteroskedastic-robust standard errors. The aim of regression 1-3 are to estimate the relationship between firm performance and CEO turnover. Regression 1 and 2 test for the negative relationship between firm performance and CEO turnover (H1). Both regression models will be estimated for family and non-family firms separately. Firstly however, we simply estimate a logistic regression with CEO turnover and lagged ROA only, as specified below:

(1A)

$$Pr(\text{CEO turnover})_t = \alpha + \beta_1 \text{ ROA}_{t-1} + \text{Year fixed effects} + \text{Industry fixed effects} + \varepsilon$$

We include year and industry fixed effects in all our regressions (except in the two-stage regression model, i.e. regression 5A and 5B) to control for time trend and industry-specific heterogeneity respectively. Next, we control for whether the CEO is a family member by including family CEO dummy variable, which takes the value of 1 if the CEO is part of the controlling family and 0 otherwise. Regression 1B is estimated for our sample of family firms only.

(1B)

$$Pr(\text{CEO turnover})_t = \alpha + \beta_1 \text{ ROA}_{t-1} + \beta_2 \text{ Family CEO dummy}_t + \text{Year fixed effects} + \text{Industry fixed effects} + \varepsilon$$

We expect β_1 to be significant and negative (or less than one given odds ratio) for both 1A and 1B, indicating a negative relationship between performance and CEO turnover. Moreover, we expect β_2 to be significant and negative (or less than one given odds ratio), implying a negative relationship between being a relative to the controlling family and CEO turnover.

For the next phase, we formulate a more complete regression model by adding an additional performance measure and control variables. We still use a binary variable for CEO turnover as the dependent variable. Our independent variables will be a set of variables measuring performance. Moreover, we include control variables for firm and CEO characteristics. Our regression will be similar to prior work (Huson, Parrino, & Starks, 2001; Jenter et al., 2015):

(2A)

$$Pr(\text{CEO turnover})_t = \alpha + \beta_1 \text{ ROA}_{t-1} + \beta_2 \text{ Profit dummy}_{t-1} + \beta_{3\text{-}8} \text{ Control variables} + \text{Year fixed effects} + \text{Industry fixed effects} + \varepsilon$$

To supplement our analysis, we also estimate the effect of financial performance on CEO turnover while controlling for the CEO being a relative to the controlling family in family firms, hence the additional control variable:

(2B)

$$Pr(\text{CEO turnover})_t = \alpha + \beta_1 \text{ ROA}_{t-1} + \beta_2 \text{ Profit dummy}_{t-1} + \beta_{3\text{-}8} \text{ Control variables} + \beta_9 \text{ Family CEO dummy}_t + \text{Year fixed effects} + \text{Industry fixed effects} + \varepsilon$$

Even when incorporating control variables, we expect both β_1 and β_2 to be significant and negative (or less than one given odds ratio) indicating a negative relationship between prior performance and CEO turnover.

We test for potential differences in CEO turnover sensitivity to performance across family and non-family firms (H2) by including the moderating variable family firm dummy. This dichotomous variable takes a value of 1 if the firm is considered a family firm and 0 if non-family. We estimate three separate models (3A-C). Firstly, we estimate regression 3A using the family firm dummy as an independent variable (3A). Secondly, we include family firm dummy interaction terms on the performance measures ROA and profit dummy variable (3B). Lastly, we incorporate interaction terms on all firm characteristic variables (3C). We use the full sample and the logistic regression models are specified as follows:

(3A)

$$Pr(\text{CEO turnover})_t = \alpha + \beta_1 \text{ Family firm}_t + \beta_2 \text{ ROA}_{t-1} + \beta_3 \text{ Profit dummy}_{t-1} + \beta_{4\text{-}9} \text{ Control variables} + \text{Year fixed effects} + \text{Industry fixed effects} + \varepsilon$$

(3B)

$$Pr(\text{CEO turnover})_t = \alpha + \beta_1 \text{ Family firm}_t + \beta_2 \text{ Family firm}_t * \text{ROA}_{t-1} + \beta_3 \text{ Family firm}_t * \text{Profit dummy}_{t-1} + \beta_4 \text{ ROA}_{t-1} + \beta_5 \text{ Profit dummy}_{t-1} + \beta_{6\text{-}11} \text{ Control variables} + \text{Year fixed effects} + \text{Industry fixed effects} + \varepsilon$$

(3C)

$$Pr(\text{CEO turnover})_t = \alpha + \beta_1 \text{ Family firm}_t + \beta_2 \text{ ROA}_{t-1} * \text{Family firm}_t + \beta_3 \text{ Profit dummy}_{t-1} * \text{Family firm}_t + \beta_4 \ln(\text{revenues})_t * \text{Family firm}_t + \beta_5 \ln(\text{firm age})_t * \text{Family firm}_t + \beta_6 \text{ ROA}_{t-1} + \beta_7 \text{ Profit dummy}_{t-1} + \beta_8 \ln(\text{revenues})_t + \beta_9 \ln(\text{firm age})_t + \beta_{10\text{-}15} \text{ Control variables} + \text{Year fixed effects} + \text{Industry fixed effects} + \varepsilon$$

For regression 3A-C, we anticipate β_1 to be significant and negative (or less than one given odds ratio), indicating a negative relationship between being a family firm and CEO turnover probability, consistent with our results from the univariate analysis in Section 5.1. In regression model 3B-C, we expect β_2 to be significant and positive (or greater than one given odds ratio), implying that CEO turnover is less sensitive to prior firm performance in family firms than in non-family firms.

Regressions 3A-C are also used in our matched sample analysis, whereas we employ propensity score matching to create a group of similar firms across family and non-family firms. This approach is further explained in the succeeding Section (5.7.1.1).

5.7.1.1 Matched Sample Analysis using Propensity Score Matching

Family firms and non-family firms have systematic differences in firm characteristics, as discussed in Section 2.3. To account for these differences and their potential effect on CEO turnover, we utilize the propensity score matching approach to form a matched sample using the one-to-one nearest-neighbour matching algorithm without replacement. Subsequently, we estimate regression 3A-C on family firms and their propensity score matched non-family firms.

In our matched sample analysis, family firms are in the treatment group, while non-family firms are in the control group. The outcome is CEO turnover.
We match family firms with non-family firms on the independent and control variables (excluding family CEO dummy) specified in Section 4.2. To reiterate, the matching variables are thus as follows: ROA, profit dummy, ln(revenue), ln(firm age), CEO age, CEO ownership, ln(CEO tenure), and ln(number of firms in the region). Finally, we use the logistic model to calculate the propensity score. The result of the matching is provided in Appendix 9.

5.7.2 Linear GLS Regression on Post-CEO Turnover Performance

Next, we want to examine whether CEO turnover to performance sensitivity is related to effective monitoring. To explore this matter, we estimate the post CEO turnover performance as an indicator of an effective CEO turnover decision (H3). For hypothesis H3, we employ the linear GLS regression on the full sample with random effects and heteroskedastic-robust standard errors. The aim of regression 4 is to estimate the change in performance following a CEO replacement. By including independent variables on both family firm turnover and non-family firm turnover, we can determine whether performance following a CEO turnover increase relatively more in family firms than in non-family firms (H3). Our dependent variable is thus delta performance post-turnover, which is defined as the delta in ROA between year t+3 and t+1 following a turnover in year t. This is reasoned by CEOs using 2,5 to 4 years to leave his/her mark in a firm (Gabarro, 1987). Moreover, we use family and non-family firm turnover as two independent variables which takes the value of 1 if a CEO replacement occur in year t and 0 otherwise. The control variables are the same as in the former regressions (excluding family CEO dummy variable), as defined in Section 4.2. In addition, we control for the firm performance prior to the turnover, i.e. lagged ROA, so that the improvement is measured while keeping the firm performance prior to the turnover constant, hence measuring the real firm performance improvement.

(4)

$$\text{Delta ROA post-turnover}_{t+3} = \alpha + \beta_1 \text{ Family firm turnover}_t + \beta_2 \text{ Non-family firm turnover}_t + \beta_{3\text{-}8} \text{ Control variables} + \beta_9 \text{ ROA}_{t-1} + \text{Year fixed effects} + \text{Industry fixed effects} + \varepsilon$$

We expect β_1 to be positive and significant given the hypothesis of more effective monitoring in family firms and thus greater firm performance improvements following CEO replacement. Moreover, to determine the difference in performance improvement between family and non-family firms, we test for equality of coefficients using the chi square test. We expect to reject the null hypothesis of equal turnover coefficients for family and non-family firms given better monitoring in family firms. Using this approach, we can examine whether there is a statistically significant difference between family firms and non-family firms in firm performance improvement following a CEO replacement. As such, this analysis could help establish whether the CEO turnover was a result of effective monitoring.

5.7.3 Two-Stage Regression Model on CEO Turnover with Exogenous Shocks

In this section, we employ a two-stage regression model to estimate whether family firms replace their CEO due to exogenous shocks (H4). If CEO turnover decision are not sensitive to exogenous shocks, it could be an indicator of effective monitoring. To estimate exogenous shocks, we take inspiration from Jenter et al. (2015) and estimate a two-stage regression model. We estimate the model for both family and non-family firms separately to analyse potential differences. We use industry returns as a proxy for exogenous shock. The industry return on assets (IROA) is defined as the average return on assets for all sample firms in each industry.

The first stage linear regression is as follows:

(5A)

$$\text{ROA}_{t-1} = \alpha + \beta_1 \text{ IROA}_{t-1} + \varepsilon_{t-1}$$

From the first stage regression, we expect β_1 to be significant and large, as a prospering industry should drive good returns in general for firms operating in that industry.

In the second stage, we employ a logistics regression on CEO turnover with the predictive values from the first stage regression (i.e. regression 5A). $\widehat{ROA}_{t-1}$ is defined as the ROA predicted by industry return (i.e. exogenous shock proxy) and is basically an instrumental variable, while the predicted residuals, $\hat{\varepsilon}_{t-1}$, is the idiosyncratic firm performance component. We do notice that $\hat{\varepsilon}_{t-1}$ includes both CEO skill and other non-industry exogenous shocks. Nonetheless, given that other exogenous shocks do not exceed the CEO ability, the idiosyncratic firm performance component is a downward biased estimate of the relationship between CEO turnover and CEO quality. ROA predicted by industry returns (i.e. $\widehat{ROA}_{t-1}$) control for industry differences and thus we only add control for year fixed effects. Hence, we estimate the following logistic regression:

(5B)

$$\Pr(\text{CEO turnover})_t = \alpha + \beta_1 \widehat{ROA}_{t-1} + \beta_2 \hat{\varepsilon}_{t-1} + \text{Year fixed effects} + v$$

We hypothesize that exogenous shocks do not affect CEO turnover decisions in family firms, hence we expect $\widehat{ROA}_{t-1}$ to have an insignificant effect on CEO turnover. On the other hand, we believe $\hat{\varepsilon}_{t-1}$ (i.e. idiosyncratic firm performance) has a significant effect on CEO turnover, suggesting that family firms dismiss the CEO based on firm-specific factors rather than exogenous shocks. To some extent, the idiosyncratic firm performance is driven by CEO skill and thus we expect the coefficient β_2 to be less than zero (or less than one given odds ratios), implying a negative relationship between CEO turnover and CEO skill.

5.7.4 Logistic Regression on Outside CEO Successor

As another indicator of effective monitoring, we test whether an outside CEO succession is more likely in family firms when prior firm performance is poor (H5). The dependent variable in this regression model is outside CEO successor, which takes the value of 1 if an outsider (i.e. unrelated to the controlling family) replaces the CEO and 0 otherwise. The control variables are the same as in the main regressions (excluding family CEO dummy variable), as defined in Section 4.2. The logistic regression model is estimated on family firms only and is specified as follows:

(6)

$$\Pr(\text{outside CEO successor})_t = \alpha + \beta_1 \text{ ROA}_{t-1} + \beta_2 \text{ Profit dummy}_{t-1} + \beta_{3\text{-}8} \text{ Control variables} + \text{Year fixed effects} + \text{Industry fixed effects} + \varepsilon$$

We hypothesize that given effective monitoring, the board of family firms should look beyond the limited candidate pool of inside CEO candidates and hire an outsider when the firm is in need of a new strategic direction (i.e. when the firm is performing poorly). Hence, we expect β_1 and β_2 to be significant and negative (or less than one given odds ratio).

5.8 Regression Analysis

In this section, we will present and analyse the results from estimating the regression models specified in Section 5.7. The theoretical framework developed in Section 2.4 and its corresponding hypothesis provide the structure of the analysis. We will thus start with the classical relationship between prior firm performance and CEO turnover in segment 5.8.1 where we present the results of H1 and H2. Next, we examine whether any differences in CEO turnover to performance sensitivity in family and non-family firms are driven by better monitoring by testing H3, H4 and H5. This builds on the agency theory as well as the stewardship and stagnation perspectives in a family firm context.

For the logistic regressions (i.e. regression 1A-B, 2A-B, 3A-C, 5B, and 6), we report the odds ratios, heteroskedastic-robust standard errors, and marginal effects. For the linear regressions (i.e. regression 4 and 5A), we report the coefficients and heteroskedastic-robust standard errors. We do not analyse insignificant values any further. Because we estimate a logistic regression using panel data, Stata does not provide us with a Pseudo R^2. However, we do obtain statistically significant results of the overall fit for all our models as indicated by the p-score of the likelihood ratio chi square test provided by Stata. Hence, we can conclude that our variables indeed are good predictors for CEO turnover (or outside CEO successor as in regression 6).

5.8.1 The Classical Relationship between Firm Performance and CEO Turnover

Hypotheses 1 and 2 both consider the relationship between CEO turnover and firm performance. We estimate regression model 2A-B to test H1 in Section 5.8.1.1, and regression model 3A-C to test H2 in Section 5.8.1.2. In Section 5.8.1.3, we estimate the same regressions model 3A-C on a matched sample using propensity score matching. To reiterate, the hypotheses we test in this chapter are:

> **H1:** *The likelihood of CEO turnover is negatively related to prior firm performance*
> **H2:** *CEO turnover to prior firm performance sensitivity is lower in family firms than in non-family firms*

5.8.1.1 CEO Turnover to Prior Firm Performance Sensitivity

The result of the initial logistic regressions 1A-B are provided in Table 5. We find a negative relationship between CEO turnover and prior firm performance for both family and non-family firms, statistically significant at the 1% level. The negative relationship is implied by an odds ratio less than one, or similarly by the negative marginal effect. Moreover, in panel C we see that being an outsider CEO significantly increases the likelihood of being replaced, indicated by the odds ratio greater than one. Moreover, we note that the odds ratio on ROA in family firms (0,835) is lower than the odds ratio in non-family firms (0,859), suggesting that CEO turnover in private family firms may in fact be more sensitive to performance than in private non-family firms.

TABLE 5 - CEO Turnover to Performance Sensitivity in Non-Family and Family Firms

*Table 5 provides the results of regression model 1A-B assessing the difference in CEO turnover between non-family firms and family firms without control variables. Regression 1A was performed on each sub-sample of non-family firms and family firms presented in panel A and B respectively, while regression 1B is presented in panel C. The marginal effect for dummy variables is defined as the discrete change from 0 to 1. Definitions of all variables can be found in Chapter 4.2. All NOK values are in 2015 NOKs. Year and industry fixed effects are incorporated in the model. Robust standard errors (SE) were applied to account for potential heteroskedasticity. *, **, and *** imply significance at the 10%, 5%, and 1% levels respectively.*

Dep. var.: CEO turnover	Panel A: Non-Family Firms			Panel B: Family Firms			Panel C: Family Firms		
				Excl. family CEO dummy			Incl. family CEO dummy		
Variables	Odds Ratio	Marginal effects	Robust SE	Odds Ratio	Marginal effects	Robust SE	Odds Ratio	Marginal effects	Robust SE
Constant	0,037***		0,003	0,019***		0,002	0,041***		0,005
ROA	0,859***	-0,003	0,024	0,835***	-0,003	0,041	0,853***	-0,003	0,041
Family CEO dummy							0,402***	0,020	0,027
Year fixed effects		Yes			Yes			Yes	
Industry fixed effects		Yes			Yes			Yes	
Number of observations		119 449			70 443			70 443	

To further investigate the relationship, we estimate regression 2A-B, which implements control variables. The regression result of the classical relationship between CEO turnover and firm performance is provided in Table 6. We find support for H1 for both family and non-family firms. For non-family firms (Table 6, Panel A), both poor ROA and negative profit predict CEO turnover, significant at the 10% and 1% level respectively. Family firms on the other hand obtain an insignificant profit dummy coefficient, however ROA is significant at the 1% level (Table 6, Panel B). This is largely in line with prior research (Gao et al., 2017, González et al., 2015; Huson et al., 2001; Dennis et al., 1997; Kaplan, 1994b).

A possible explanation of the insignificant profit dummy variable for family firms may be that family firms typically inherit more of a long-term focus and thus do not replace the CEO only because of a year with negative profits. The longer-term focus is due to a more concentrated ownership (Berzins et al., 2018; La Porta et al., 1998). However, looking at the data, we also know that family firms are unlikely to make a loss in the first place (see Section 5.1 and Figure 1), which is another plausible explanation for the insignificant profit dummy variable.

Interestingly, the discrepancy between family and non-family firms on the marginal effects of ROA on CEO turnover is even starker after implementing control variables. The discrepancy remains large even when controlling for family

CEO. Now, the odds ratio for ROA is 0,907 for non-family firms (Table 6, Panel A), while it is as little as 0,697 for family firms (Table 6, Panel B), and 0,704 when controlling for family CEO as well (Table 6, Panel C).

Economically, this means that if ROA where to be reduced from the sample median to its 25th percentile median in a non-family firm (i.e. a decrease of 8%), the CEO is 0,024% (0,024% = 0,003 * 8%) more likely to be fired. In a family firm on the other hand, reduction in ROA to its 25th percentile median gives a 0,056% (0,056% = 0,007 * 8%) higher likelihood of CEO replacement.

TABLE 6 - CEO Turnover to Performance Sensitivity in Non-Family and Family Firms with Control Variables

*Table 6 provides the results of regression model 2A-B assessing the difference in CEO turnover between non-family firms and family firms. Panel A and B constitute regression 2A, while panel C constitutes regression 2B results including family CEO dummy variable for family firms. The marginal effect for dummy variables is defined as the discrete change from 0 to 1. Definitions of all variables can be found in Chapter 4.2. All NOK values are in 2015 NOKs. Year and industry fixed effects are incorporated in the model. Robust standard errors (SE) were applied to account for potential heteroskedasticity. *, **, and *** imply significance at the 10%, 5%, and 1% levels respectively.*

Dep. var.: CEO turnover	Panel A: Non-Family Firms			Panel B: Family Firms			Panel C: Family Firms		
				Excl. non-family CEO dummy			Incl. family CEO dummy		
Variables	Odds Ratio	Marginal effects	Robust SE	Odds Ratio	Marginal effects	Robust SE	Odds Ratio	Marginal effects	Robust SE
Constant	0,022***		0,008	0,002***		0,001	0,003***		0,002
ROA	0,907*	-0,003	0,048	0,697***	-0,007	0,063	0,704***	-0,007	0,063
Profit dummy	0,865***	-0,005	0,043	0,943	-0,001	0,076	0,945	-0,001	0,077
Family CEO dummy							0,579***	-0,013	0,065
ln(revenue)	1,113***	0,003	0,016	1,198***	0,003	0,032	1,190***	0,003	0,031
ln(firm age)	1,001	0,000	0,035	0,992	-0,000	0,049	0,997	-0,000	0,049
CEO age	1,015***	0,001	0,002	1,022***	0,000	0,004	1,023***	0,000	0,004
CEO ownership	0,975***	-0,001	0,001	0,985***	-0,000	0,003	0,988***	-0,000	0,003
ln(CEO tenure)	0,775***	-0,008	0,037	0,774***	-0,005	0,057	0,778***	-0,005	0,058
ln(number of firms in region)	0,952*	-0,002	0,026	0,968	-0,001	0,044	0,969	-0,001	0,044
Year fixed effects		Yes			Yes			Yes	
Industry fixed effects		Yes			Yes			Yes	
Number of observations		72 681			42 227			42 227	

5.8.1.2 Difference in CEO Turnover to Performance Sensitivity between Family and Non-Family Firms

To examine differential turnover rates across family and non-family firms, we estimate regression models 3A-C. In these regressions, the principal variable of interest is the dichotomous family firm variable. Principally, this variable picks up the incremental differences between family and non-family firm regarding CEO turnover to performance sensitivity. The models test for H2 and the results are presented in Table 7.

Surprisingly, we do not find support for H2, but rather find support for the alternative hypothesis, namely that family firms are *more* likely than non-family firms to replace its CEO when prior firm performance is poor. In Table 7, Panel A, we estimate regression model 3A on the full sample and find that the family firm dummy variable is statistically significant at the 1% level with a negative marginal effect. This means that if a firm is considered a family firm rather than non-family firm, the CEO is 13% less likely to be fired, confirming our initial univariate analysis from the descriptive statistics (see Section 5.1, Table 4).

In Table 7, Panel B and C estimate regression model 3B and 3C respectively, which include the family firm interaction terms. Here, the interaction terms on the performance measures are of principal interest. In both Panel B and C, we see that the marginal effect of the interaction term between the family firm dummy variable and ROA is negative and statistically significant at the 5% level. Hence, we find evidence that family firms are significantly *more* sensitive to performance (as measured by ROA) than non-family firms in replacing the CEO. This is in contrast with our expectations and thus surprising findings.

When it comes to the economic implication, it means that when ROA decreases from the sample median to its 25^{th} percentile median (i.e. a decrease of 8%), the CEO in a non-family firm is 0,024% (0,024% = 0,003 * 8%) more likely to be replaced. By comparison, the likelihood of a CEO turnover in a family firm would increase by as much as 0,064% (0,064% = [0,003 + 0,005] * 8%). Including interaction terms on all firm characteristic variables in Panel C, we find slightly starker differences. Now the economic significance is even greater with the marginal effect for the family firm interaction on ROA enlarged to -0,006. Thus, CEO turnover in family firms increases by 0,072%, while the probability for non-family firms remain largely similar at 0,024%.

On one hand, the greater sensitivity of CEO turnover to prior firm performance in family firms could suggest presence of myopia in family firms, which oppose the stewardship perspective. However, myopia contrasts our findings in the univariate analysis of significantly fewer turnovers in private family firms than in private non-family firms. Thus, we find myopia in family firms as an unlikely explanation. On the other hand, the greater CEO turnover to prior firm performance sensitivity could indicate effective corporate governance mechanisms, penalizing the CEO that delivers poor financial performance (González et al., 2015). We will test whether our results on CEO turnover decisions suggest effective monitoring in the subsequent chapter (5.8.2).

TABLE 7 - Difference in CEO Turnover Sensitivity to Performance between Non-Family and Family Firms

*Table 7 provides the results of regression model 3A-C assessing the marginal effect of performance sensitivity in family firms on CEO turnover versus non-family. Panel A constitutes regression 3A with family firm dummy variable included. Panel B presents the results of regression 3B including interaction terms on performance. Panel C provides the results of regression 3C incorporating interaction terms on all variables of firm characteristics. The marginal effect for dummy variables is defined as the discrete change from 0 to 1. Definitions of all variables can be found in Chapter 4.2. All NOK values are in 2015 NOKs. Year and industry fixed effects are incorporated in the model. Robust standard errors (SE) were applied to account for potential heteroskedasticity. *, **, and *** imply significance at the 10%, 5%, and 1% levels respectively.*

Dep. var.: CEO turnover	Panel A: Full Sample			Panel B: Full Sample			Panel C: Full Sample		
	Excl. interaction terms			Incl. Inter. terms on performance			Incl. inter. terms on all firm variables		
Variables	Odds Ratio	Marginal effects	Robust SE	Odds Ratio	Marginal effects	Robust SE	Odds Ratio	Marginal effects	Robust SE
Constant	0,014***		0,004	0,014***		0,004	0,018		0,006
Family firm dummy	0,587***	-0,013	0,024	0,540***	-0,015	0,040	0,198***	-0,037	0,082
ROA * Family firm dummy				0,813**	-0,005	0,084	0,785**	-0,006	0,082
Profit dummy * Family firm dummy				1,142	0,004	0,107	1,094	0,002	0,104
ln(revenue) * Family firm dummy							1,070**	0,002	0,031
ln(firm age) * Family firm dummy							1,021	0,001	0,048
ROA	0,847***	-0,004	0,039	0,891**	-0,003	0,047	0,899**	-0,003	0,048
Profit dummy	0,884***	-0,003	0,037	0,858***	-0,004	0,042	0,869***	-0,004	0,043
ln(revenue)	1,135***	0,003	0,014	1,136***	0,003	0,014	1,116***	0,003	0,016
ln(firm age)	1,001	0,000	0,028	1,002	0,000	0,028	0,993	-0,000	0,031
CEO age	1,017***	0,000	0,002	1,017***	0,000	0,002	1,017***	0,000	0,002
CEO ownership	0,977***	-0,001	0,001	0,978***	-0,001	0,001	0,978***	-0,001	0,001
ln(CEO tenure)	0,770***	-0,007	0,031	0,769***	-0,007	0,001	0,770***	-0,007	0,031
ln(number of firms in region)	0,957*	-0,001	0,023	0,955*	-0,001	0,023	0,956*	-0,001	0,023
Year fixed effects		Yes			Yes			Yes	
Industry fixed effects		Yes			Yes			Yes	
Number of observations		114 934			114 813			114 813	

5.8.1.3 Matched Sample Analysis

The results of the logistic model only including propensity score matched firms (Appendix 9) are presented in Table 8. Interestingly, when using matched family and non-family firms, the differences in CEO turnover to performance sensitivity becomes even more pronounced. By comparison, estimating regression 3A-C on a matched sample gives a ROA * Family firm dummy odds ratio of 0,775 (Table 8, Panel B), while it is 0,813 without matching the group (Table 7, Panel B). Both odds ratios are significant at the 5% level. This means that the marginal effect of poor performance is even more prominent when family and non-family firms are matched, providing further robustness to our results.

In conclusion, we find evidence indicating that family firms are more likely to respond to poor firm performance (as measured by lagged ROA) by replacing its

CEO than non-family firms. The result is robust to different performance measures and empirical models (see Section 5.9). Hence, we reject H2 in favour of the alternative hypothesis. Even though these results are surprising, Kaplan and Minton (2012) argue that turnover at well-governed firms should be more sensitive to performance. Hence, our results could in fact indicate more effective monitoring in family firms. In the next section, we will analyse whether effective monitoring in family firms drives the greater sensitivity to performance in CEO decision making.

TABLE 8 - Propensity Score Matched Sample

*Table 8 provides the results of regression model 3A-C on a propensity matched sample, assessing the marginal effect of performance sensitivity in family firms on CEO turnover versus non-family. Panel A constitutes regression 3A with family firm dummy variable included. Panel B presents the results of regression 3B including interaction terms on performance. Panel C provides the results of regression 3C incorporating interaction terms on all variables of firm characteristics. The marginal effect for dummy variables is defined as the discrete change from 0 to 1. Definitions of all variables can be found in Chapter 4.2. All NOK values are in 2015 NOKs. Year and industry fixed effects are incorporated in the model. Robust standard errors (SE) were applied to account for potential heteroskedasticity. *, **, and *** imply significance at the 10%, 5%, and 1% levels respectively.*

Dep. var.: CEO turnover	Panel A: Full Sample			Panel B: Full Sample			Panel C: Full Sample		
	Excl. interaction terms			Incl. inter. terms on performance			Incl. inter. terms on all firm variables		
Variables	Odds Ratio	Marginal effects	Robust SE	Odds Ratio	Marginal effects	Robust SE	Odds Ratio	Marginal effects	Robust SE
Constant	0,018***		0,006	0,018***		0,007	0,028		0,011
Family firm dummy	0,586***	-0,013	0,025	0,591***	-0,013	0,048	0,164***	-0,044	0,070
ROA * Family firm dummy				0,775**	-0,006	0,091	0,744**	-0,007	0,088
Profit dummy * Family firm dummy				0,996	-0,000	0,104	0,951	-0,001	0,099
ln(revenue) * Family firm dummy							1,099***	0,002	0,033
ln(firm age) * Family firm dummy							0,969	-0,001	0,041
ROA	0,837***	-0,004	0,051	0,934	-0,002	0,075	0,947	-0,001	0,075
Profit dummy	0,967	-0,001	0,500	0,971	-0,001	0,064	0,989	-0,000	0,065
ln(revenue)	1,130***	0,003	0,017	1,127***	0,003	0,017	1,092***	0,002	0,019
ln(firm age)	1,051*	0,001	0,030	1,053*	0,001	0,030	1,061*	0,001	0,036
CEO age	1,021***	0,001	0,002	1,021***	0,001	0,002	1,021***	0,001	0,002
CEO ownership	0,978***	-0,001	0,001	0,978***	-0,001	0,001	0,978***	-0,001	0,002
ln(CEO tenure)	0,725***	-0,008	0,028	0,723***	-0,008	0,028	0,724***	-0,008	0,028
ln(number of firms in region)	0,908***	-0,002	0,025	0,906***	-0,002	0,025	0,906***	-0,002	0,025
Year fixed effects		Yes			Yes			Yes	
Industry fixed effects		Yes			Yes			Yes	
Number of observations		83 821			83 763			83 763	

5.8.2 Monitoring and CEO Turnover Decision Making in Family Firms

In this section, we examine whether CEO replacement in family firms is driven by effective monitoring. In this section we thus test H3, H4, and H5. We estimate regression model 4 to test H3 in Section 5.8.2.1. In Section 5.8.2.2, we estimate the two-stage regression model (i.e. regression 5A and 5B) to test H4. Lastly, we test H5 by estimating regression model 6 in Section 5.8.2.3. To reiterate, the hypotheses we test in this chapter are:

> **H3:** *Performance following a CEO turnover increase relatively more in family firms than in non-family firms*

H4: *CEO turnover decisions in family firms are not affected by exogenous shocks*
H5: *In family firms, the likelihood of outside CEO succession is negatively related to prior firm performance*

5.8.2.1 Post-Turnover Improvement in Performance

To test H3, we estimate regression model 4, examining the improvements in performance following CEO turnover. The results are presented in Table 9. The principal variable of interest in regression model 4 is the family firm and non-family firm turnover variables. We find moderate support for H3. The results imply that performance improvement following CEO turnover is more prominent in family firms than in non-family firms, implied by the higher coefficient significant at the 10% level. Thus, consistent with our expectations, there is a statistically significant positive relationship between CEO replacement and post-turnover firm performance in family firms. An increase in post-turnover performance may be a proxy of the quality of the turnover and consequently indicate effective monitoring (Huson et al., 2004). For non-family firms on the other hand, the insignificant coefficient for non-family firm turnover may imply that non-family firms dismiss the CEO prematurely. This could be a sign of greater myopia in non-family firms compared to family firms. Thus, we conclude that family firms may employ better monitoring, indicated by efficient turnover decisions. However, in contrast to our expectations, the chi square test fails to reject the equality of the effects of being a family firm versus non-family firm on post-turnover performance (Appendix 10). Hence, we only find moderate support for H3.

TABLE 9 - Performance Improvements Post CEO Turnover

*Table 9 provides the results of regression model 4 examining the performance improvements following CEO turnover in family and non-family firms. Definitions of all variables can be found in Chapter 4.2. All NOK values are in 2015 NOKs. Year and industry fixed effects are incorporated in the model. Robust standard errors (SE) were applied to account for potential heteroskedasticity. *, **, and *** imply significance at the 10%, 5%, and 1% levels respectively.*

Dep. var.: Delta ROA post-turnover	Full Sample	
Variables	Coefficient	Robust SE
Constant	-0,033	0,051
Family firm turnover (1)	0,040*	0,022
Non-family firm turnover (2)	0,011	0,014
ln(revenue)	0,004	0,002
ln(firm age)	-0,001	0,004
CEO age	-0,001**	0,000
CEO ownership	-0,000	0,000
ln(CEO tenure)	0,000	0,005
ln(number of firms in region)	-0,003	0,004
ROA	0,016	0,019
Year fixed effects	Yes	
Industry fixed effects	Yes	
Number of observations	82 765	
R^2	0,11	
Chi square statistic test of equality: (1) = (2)	0,2726	

5.8.2.2 Exogenous Shock's Influence on CEO Turnover

In this section, we test H4, namely whether the CEO turnover decision is affected by exogenous shocks. We estimate regression 5A and 5B in a two-stage linear regression model. The results are provided in Table 10, which show support for H4. Consistent with our expectations, the coefficient for IROA is large and significant at the 1% level in the first-stage regression for both family and non-family firms (Table 10, Panel 1). For non-family firms we see that industry returns explain 90,8% of all variation in firm returns, while for family firms, industry returns explain 93,1% of the variation in firm returns.

However, the second-stage regression is of main interest. Consistent with our expectations, prior firm performance predicted by industry returns has an insignificant effect on CEO turnover in family firms (Table 10, Panel 2B). Moreover, predicted prior idiosyncratic firm performance negatively affect CEO turnover in family firms, significant at the 1% level. These results indicate that exogenous shocks (proxied by industry performance) do not significantly affect CEO turnover decision in family firms, hence providing support for H4.

Furthermore, these results provide support for the socioemotional wealth perspective in family firms and is in line with recent literature on family firms' resilience towards exogenous shocks (Minichilli, Brogi & Calabrò, 2016).

For non-family firms, the situation is quite different. Here, both ROA predicted by industry returns and the predicted idiosyncratic firm performance have a significant negative effect on CEO turnover at the 1% level. This implies that the board in non-family firms does not filter out exogenous shocks in CEO turnover decision. Thus, being fired could merely be a consequence of bad luck (i.e. poor industry performance) in non-family firms. This is consistent with findings by Jenter et al. (2015).

In terms of the economic significance, this means that if the ROA predicted by industry returns decrease from the sample median to its 25^{th} percentile median (i.e. a decrease of 8%), the CEO is 0,56% (0,56% = 0,070 * 8%) more likely to be dismissed in non-family firms, while it would have an insignificant effect on family-firms. Hence, we find support for strong-form relative performance evaluation in family firms, while we reject it for non-family firms. In an agency theory context, these results could indicate less principal-agent issues in family firms, consistent with prior findings by Jensen et al. (1976) and Fama et al. (1983).

TABLE 10 - Two-Stage Logit Regression on Industry-Wide Exogenous Shock

*Table 10 provides the results of the two-stage regression model, estimating regression model 5A and 5B, assessing the effect of exogenous shocks on CEO turnover decision. Panel 1A and 1B constitute the results for linear regression 5A on non-family and family firms respectively. Panel 2A and 2B present the results of regression 5B employing the logistic regression on CEO turnover with the predicted values from the first stage regression. All NOK values are in 2015 NOKs. Year fixed effects are incorporated in the model. Robust standard errors (SE) were applied to account for potential heteroskedasticity. *, **, and *** imply significance at the 10%, 5%, and 1% levels respectively.*

	Panel 1: First-Stage Regression			
Dep. var.: ROA	Panel 1A: Non-Family Firms		Panel 1B: Family Firms	
Variables	Coefficient	Robust SE	Coefficient	Robust SE
Constant	0,013***	0,001	0,010***	0,035
IROA	0,908***	0,032	0,931***	0,001
Year fixed effects	Yes		Yes	
Industry fixed effects	No		No	
Number of observations	173 992		199 399	

	Panel 2: Second-Stage Regression					
Dep. var.: CEO turnover	Panel 2A: Non-Family Firms			Panel 2B: Family Firms		
Variables	Odds Ratio	Marginal	Robust SE	Odds Ratio	Marginal	Robust SE
Constant	0,034***		0,002	0,023***		0,002
Predicted ROA by IROA	0,035***	-0,070	0,014	0,563	-0,008	0,367
Predicted Idiosyncratic ROA	0,869***	-0,003	0,023	0,872***	-0,002	0,033
Year fixed effects	Yes			Yes		
Industry fixed effects	No			No		
Number of observations	137 333			124 879		

5.8.2.3 Outside CEO Successor

As a last measure of effective monitoring, we estimate logistic regression model 6 to test for H5. The results are presented in Table 11. We see in Table 11 that ROA has an odds ratio of 0,611 which is less than one (or negative marginal effect) as predicted, hence indicating a negative relationship between prior ROA and outside CEO succession. The ROA coefficient is significant at the 1% level, thus providing support for H5. This is consistent with former research on the topic (e.g. Minichilli, Nordqvist, Corbetta & Amore, 2014; Smith & Amoako-Adu, 1999). Similar to our prior regressions however, the profit dummy is insignificant for family firms, which again could be a result of family firms in our data rarely experiencing negative returns (see Section 5.1 and Figure 1).

In economic terms, our results indicate that the family firm is 0,016% (0,016% = 0,002 * 8%) more likely to hire an outside CEO when the sample median of ROA is reduced to its 25th percentile median (i.e. a decrease of 8%). Thus, the economic significance is not major, and we do note that there could be many other factors indicating whether a CEO is replaced with an outsider.

A plausible explanation for the significant negative relationship between prior firm performance and outside CEO succession may be that when the family firm is performing poorly, the board may find it necessary to hire a CEO with outside expertise rather than an inside CEO from a limited candidate pool. Moreover, being in a poor financial situation may lead to a different strategic direction and a need to introduce new ways of thinking, hence hiring an outside CEO (Blumentritt, Keyt & Astrachan, 2007).

Lastly, we notice that prior CEO ownership has an odds ratio less than one (or a negative marginal effect), significant at the 1% level. This means that if the pre-turnover CEO has a greater ownership stake, he is less likely to be succeeded by an outsider. A family firm with a family CEO that simultaneously obtain a significant ownership stake in the firm characterize a tightly held family firm. Such firms tend to pursue continuation of their heir (Casson, 1999; Chami, 2001; Zellweger, 2007), hence providing support for the alternative theory of stewardship and/or stagnation perspective.

TABLE 11 - Outside CEO Succession in Family Firms

*Table 11 provides the results of regression model 6, examining the relationship between outside CEO succession and firm performance. The marginal effect for dummy variables is defined as the discrete change from 0 to 1. Definitions of all variables can be found in Chapter 4.2. All NOK values are in 2015 NOKs. Year and industry fixed effects are incorporated in the model. Robust standard errors (SE) were applied to account for potential heteroskedasticity. *, **, and *** imply significance at the 10%, 5%, and 1% levels respectively.*

Dep. var.: Outside CEO Successor	Family Firms		
Variables	Odds Ratio	Marginal effects	Robust SE
Constant	0,001***		0,001
ROA	0,611***	-0,002	0,090
Profit dummy	0,796	-0,001	0,121
ln(revenue)	1,237***	0,001	0,074
ln(firm age)	0,891	-0,001	0,090
CEO age	1,009	0,000	0,007
CEO ownership	0,979***	-0,000	0,005
ln(CEO tenure)	0,939	-0,000	0,141
ln(number of firms in region)	0,878	-0,001	0,079
Year fixed effects		Yes	
Industry fixed effects		Yes	
Number of observations		37 423	

5.9 Robustness Checks

In this chapter, we conduct additional analysis to check the robustness of our results. We begin by varying the specifications of our performance measure in Section 5.9.1. More specifically, we add the performance measure delta ROA to account for the trend in ROA recognized in Figure 1. In Section 5.9.2, we estimate regression model 3A-C while controlling for the CEO being a member of the controlling family. Next, we estimate our main regressions using different empirical models, namely the probit model and the Cox Proportional Hazards model, in Section 5.9.3 and 5.9.4 respectively. Lastly, we estimate the two-stage regression model employing linear regressions in both the first and second stage, consistent with some academic papers arguing for its superiority (Gao et al., 2017; Bennedsen et al., 2007; Angrist, 2001). Both changes in our model specifications and in empirical models employed provide similar results as our main models presented in Section 5.7. This indicates that our results are robust.

5.9.1 Adding Delta ROA as an Alternative Performance Measure

In this section, we add the performance measure delta ROA as an explanatory variable to regression model 2 and 3. Delta ROA is defined as the change in ROA from year t-2 to t-1, where the CEO turnover takes place in year t. The reason for incorporating this additional performance metric is to capture any trends in ROA, as recognized in Figure 1. The results are presented in Appendix 11 and are largely similar, both in regards of predictive sign, marginal effect, and significance. Most notably, adding delta ROA to the regression model increases significance level for ROA with interaction term family dummy from the 5% level to the 10% level in regression 3, reducing the predictive power to some degree. However, it does not change the overall conclusion.

We also estimate the models by substituting lagged ROA for delta ROA. Important to notice in analysing these results is that with delta ROA, we expect a positive relationship with CEO turnover. This is due to the definition of delta ROA. For instance, if ROA declined between year t-2 and t-1 (i.e. poor performance), it means that delta ROA. The larger the decline in ROA between year t-2 and t-1, the larger the delta ROA. Thus, delta ROA is expected to be positively related to CEO turnover. The results of estimating regression model 2 and 3 with delta ROA rather than lagged ROA are reported in Appendix 12. Consistent with our expectations, we find a significant positive relationship between delta ROA and CEO turnover in family firms, implied by an odds ratio greater than one (or positive marginal effect). However, the predictive power is lower with a significance level of 10% (compared to 1% in main regression). Nonetheless, all the results lead us to draw similar conclusions as in our main regressions.

5.9.2 Adding Control Variable for Family CEO in Family Firms

In estimating regression model 3 in section 5.7.1, we do not include a control variable for being a family CEO in family firms. Logically, being blood-related to the controlling family could impact the CEO turnover decision. Thus, we check whether incorporating a control variable for this change our results. The control variable takes the value of 1 if there is a family firm with a family CEO and 0 otherwise. The results are presented in Appendix 13. Noticeably, we find that the principal variable of interest, ROA * Family firm dummy, still has a significant negative effect on CEO turnover, significant at the 10% and 5% level for regression 3B and 3C respectively (compared to 5% and 5% respectively without controlling for family CEO). The CEO turnover to prior performance sensitivity becomes slightly lower, with an odds ratio of 0,785 for ROA * Family firm dummy in the main regression estimation, compared to 0,793 when controlling for family CEO in family firm. However, the difference in marginal effect and economic significance is minimal. Hence, we conclude that our results are robust even when controlling for the CEO being a family member of the controlling family.

5.9.3 Probit Model

The logistic regression model and the probit model are successfully applied in previous research on CEO turnover estimation (Guo & Masulis, 2015). Similar to the logistic regression model, the probit model is utilized when the dependent variable (e.g. CEO turnover) only takes on two distinctive values. In our case, CEO turnover equals 1 if a CEO is replaced in year t and 0 otherwise. Moreover, the two models have similar data specification and should therefore give similar results (Brooks, 2014).

However, one difference between the logistic and probit model is regarding the distribution of the error terms (Brooks, 2014). In the logistic regression model, the distribution of the error terms is assumed to comply with the standard logistic distribution. In the probit model on the other hand, the distribution of the error terms is assumed to comply with a normal distribution. We also keep in mind that there might be differences in the case of unbalanced binary results (e.g. when CEO turnover equals 0 for 95% of the observations). Hence, we utilize the probit model as a robustness check for the results obtained from the logistic regression model.

The probit model is employed to estimate all main regressions where the logistic model was applied, i.e. regression 2A-B, 3A-C, 5B, and 6. The results are presented in Appendix 14. We report the coefficients, heteroskedastic-robust standard errors, and marginal effects. The results are largely similar, both in regards of predictive sign, marginal effect, and significance, and lead us to draw the same conclusions as in the main regressions. This further adds to the robustness of our main results.

5.9.4 Survival Model

CEO turnover is considered an unusual event, and consequently we identify survival analysis as a suitable method of analysis (Furtado & Karan, 1990). Logistic regressions and survival analysis are both commonly used multivariate models to investigate CEO turnover. Using survival analysis will add robustness to our findings and provide advantages such as restraining sample selection issues stemming from censoring (Allison, 2010) and incorporating further time series variation in parameter estimates (Cox & Oakes, 1984).

5.9.4.1 Cox Proportional Hazards Model

The Cox Proportional Hazards (CPH) model estimate the effect of one or several predictors when a specified event occurs. Hence, the outcome that disclose this effect is called the hazard rate. In the CPH model, each distinctive effect of a unit increase in a predictor is multiplicative with respect to the hazard rate (Cox, 1972). For instance, given that the CEO is from the controlling family, the firm’s hazard rate for CEO turnover may halve. Moreover, the hazard rate is viewed as the immediate probability of a specified event happening at any point in time. We can also think about the hazard rate as the relative risk of the event to find place. The specified regression model can be written as follows:

$$h(t) = h_0(t)\ \mathrm{e}^{(\beta_1 X_1 + \beta_2 X_2 + \cdots + \beta_p X_p)}$$

h(t) is the hazard rate and the hazard rate equals $h_0(t)$ when all the independent variables $X_1,\ldots,X_p$ equals zero. The betas ($\beta_1, \beta_2 \ldots, \beta_p$) explain the effect of the independent variables on the hazard rate h(t).

The results of estimating our main regressions (i.e. regression 2 and 3) utilizing the CPH model are presented in Appendix 15. Note that Stata provides us with hazard ratios, which is the hazard rate from the treatment group divided by the hazard rate from the control group. We report the hazard ratios and the heteroskedastic-robust standard errors.

Consistent with our main results for regression model 2A, we find that there is a significant negative relationship between lagged ROA (lagged profit dummy) and CEO turnover for family firms (non-family firms). The negative relationship is indicated by a hazard ratio less than one. However, for family firms, the significance level of ROA is 5% rather than 1% in our main results. The results remain similar when controlling for family CEO in regression model 2B. Notably, our principal variable of interest in regression model 3B-C, namely ROA * family firm dummy, is significant at the 10% level and yield a hazard ratio of 0,838 and 0,826 for regression model 3B and 3C respectively. Given that the hazard ratio is less than one, it indicates that family firms are *more* sensitive to poor performance in replacing their CEO, consistent with our main results. For instance, the hazard ratio of 0,826 means that if you are a CEO at a family firm and ROA decreases by one unit, you have a 17% higher turnover rate compared to that of a CEO in a non-family firm in the same situation. This, in conjunction with the probit model, further adds robustness to our main results.

5.9.5 Two-Stage Linear Regression Model

Lastly, we conduct an additional robustness check for the two-stage regression model. Our main two-stage regression model, where we employ a linear regression in the first stage and a non-linear logistic regression in the second-stage, is inspired by Jenter et al. (2015). However, other academic papers have argued that one should employ linear regression in both the first and the second-stage (Gao, 2017; Bennedsen et al., 2007; Angrist, 2001). They argue that the latter two-stage regression model will yield consistent second-stage estimates, whereas the former by Jenter et al. (2018) will not. The results of employing a linear regression in both the first-stage and the second-stage are presented in Appendix 16. Our results are consistent with our main results in term of significance and predictive sign, and thus lead us to draw the same conclusions.

6. Conclusion

The purpose of this thesis is to examine the relationship between CEO turnover and firm performance in private Norwegian family firms with the moderating effect of family ownership, and whether the decision is driven by effective monitoring.

CEO turnover is a frequently discussed topic and one of the key corporate governance mechanisms. Because of more easily accessible data, most prior research on CEO turnover has been on public firms. Noting the significance of private family firms in the global economy, we conduct our research on private Norwegian family firms. The sensitivity of CEO turnover to prior firm performance is a subject that is largely unexplored in a Norwegian context, and the extensive dataset provided by CCGR provides a unique opportunity to gain robust insight into the topic.

Building on prior research and corporate governance theory, we develop five hypotheses. The first two regard the sensitivity of CEO turnover to prior firm performance, including differences between private family firms and private non-family firms. The last three hypotheses examine whether the CEO turnover decision was a result of effective monitoring.

In the first hypothesis, we argue that there should be a negative relationship between CEO turnover and prior firm performance. We test the hypothesis for private family and private non-family firms separately. The results indicate a significant negative relationship between CEO turnover and prior firm performance for both private family firms and private non-family firms. This is consistent with prior research on the topic.

In the second hypothesis, we expect that the sensitivity of CEO turnover to performance is more pronounced in private non-family firms than in private family firms. We argue that family firms value other factors, such as socioemotional goals, in addition to economical. Contrary to our expectations, even though private family firms experience significantly fewer turnovers overall, they are significantly more sensitive to prior firm performance in replacing their CEO than private non-family firms. The discrepancy becomes even starker after applying the propensity score matching model. However, the result of the third hypothesis shows that firm performance increases significantly more in private family firms following CEO turnover than in private non-family firms, implying efficient CEO turnover decisions. Thus, the result of the third hypothesis implies that the greater CEO turnover to firm performance sensitivity is a result of effective corporate governance mechanisms in family firms.

The results from testing the fourth and fifth hypothesis provide additional support for effective monitoring and thus efficient CEO turnover decisions in private family firms. In the fourth hypothesis, we expect that family firms are not affected by exogenous shocks in their CEO turnover decision. We find significant support of strong-form relative performance evaluation in private family firms, but not in private non-family firms. This indicates that the board of directors in private family firms filter out factors that are outside the CEO’s control in making their CEO turnover decisions. In contrast, CEOs in private non-family firms may be fired due to bad luck (i.e. poor industry-wide performance). In the fifth and last hypothesis, we predict that poor firm performance leads family firms to realize the need for an outside CEO that can form a new strategic direction, implying efficient CEO turnover replacement. In line with our expectations, we find significant support for a negative relationship between hiring an outside CEO and prior firm performance in private family firms.

Our results indicate a more transparent relationship between the principal (board) and the agent (chief executive) in private family firms than in private non-family firms. We find that the CEO is efficiently replaced in family firms when idiosyncratic performance is poor, driven by effective monitoring. Moreover, our results of significantly less frequent CEO turnovers in private family firms than in private non-family firms supports the stewardship perspective, where the CEO acts as a steward working towards maximizing shareholder value in family firms.

In this thesis, we have provided evidence showing that Norwegian private family firms are more sensitive to prior firm performance in replacing their CEO than private Norwegian non-family firms. Moreover, we have argued conceptually and shown empirically that this relationship is a consequence of more effective monitoring. We note that there is no similar study that has examined this relationship on family firms in a Norwegian context. Hence, the relationships discovered in this thesis could contribute to a better understanding of agency conflicts within private Norwegian firms. Moreover, we highlight the importance of monitoring by examining the differences between private family firms and non-family firms in CEO turnover decision making. Finally, we encourage other scholars to improve our model and continue investigating different drivers of CEO turnover in private Norwegian family firms.

6.1 Limitations

It is worth mentioning that despite the significance in our regression analysis, our data still suffer from certain limitations. For instance, given that our time horizon starts from year 2000, it is uncertain how long the chief executive has been in his/her position prior to this year. Hence, CEO tenure equals zero in year 2000 and the maximum CEO tenure period is 17 years. Another limitation in CEO characteristics is the inability to distinguish between CEOs that have the same birth year. Thus, if a CEO was to be replaced with another CEO that was born in the same year, our data would not pick it up as a CEO turnover (see definition of CEO turnover in Section 4.2). However, we do find this occurrence unlikely and due to our large sample, it should not be a significant concern. Furthermore, our data contain many missing values of key variables (e.g. ultimate family ownership), and thus many firms were excluded from the data. As a consequence, our final data sample suffers from a relatively small number of firms in certain industries. Nonetheless, we do control for industry-specific heterogeneity in our regression models, hence we do not find this a major limitation.

Moreover, our dataset does not provide firm names or any specification that enable us to condition our regression models on forced and voluntary turnover, which is common in recent research on CEO turnover (e.g. Jenter et al., 2015). Hence, our results are likely downward biased to some degree. However, recent literature review on CEO turnover has been critical to dividing into forced and voluntary turnover due to classification issues (Fee et al., 2017). Thus, we do not find this a major limitation.

Most of our regressions could likely benefit from incorporating an instrumental variable. For example, for regression model 6, where we estimate the likelihood of outside CEO succession in family firms, we could benefit from including an instrumental variable to control for potential endogeneity issues. An example of such an instrumental variable is the gender of the departing CEO’s firstborn child, first introduced by Bennedsen et al. (2007). However, our dataset does not provide us with such variable, neither does it provide any information that would enable us to manually extract such information for each firm. Nonetheless, the fact that we use panel data mitigates the issue of endogeneity.

Lastly, as discussed in Section 2.3, we identify family firms as firms where the family has an ultimate ownership stake larger than 50%. Even though we find this the most appropriate measure for Norwegian firms, it is still a debatable topic. Moreover, studies in other countries may use different definitions for family firms, which make it harder to compare our results directly to other studies.

6.2 Further Research

In further research, the model could be tested on Norwegian public family firms, using stock returns as a performance measure. It could also be beneficial to apply the model in other Nordic countries. This could provide a broader understanding of different corporate governance characteristics across Nordic countries, including monitoring effect on chief executive dismissal.

Moreover, further research could be performed on exogenous shocks. In this thesis, we focused on general industry-wide shocks. However, it could be interesting to look at more specific exogenous shocks that only affected some branches, such as the oil crash in 2014. Due to the limited number of family-owned oil companies in our data, we found it inefficient to conduct such analysis ourselves. However, it would be a useful amendment to the more general case of industry-wide exogenous shock, and a compelling way to deal with potential endogeneity issues.

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Appendix

Appendix 1 – Variable List

Variable List

CCGR Data Code	Variable Name
Item_2	CEO Gender
Item_4	CEO birth year
Item_9	Revenues
Item_19	Operating income
Item_30	Other interest expenses
Item_39	Net income
Item_63	Total fixed assets
Item_78	Total current assets
Item_87	Total equity
Item_503	Firm location
Item_602	Board size
Item_11102	Industry code
Item_13421	Firm foundation
Item_13601	CEO ownership
Item_14507	Independent
Item_15302	Family ownership
Item_15304	Family CEO
Item_15308	Family board
Item_17002	Listed
Item_50109	Number of employees

Appendix 2 – Region Categorization

Region Categorization

This table provides the postal code and corresponding geographic location. In Norway, the two first numbers of the postal code indicates its region.

Postal Code	Region	Region Code	Abbreviation
00-12	Oslo	1	OSL
13-14, 19-20	Akershus	2	AKR
15-18	Østfold	3	ØFO
21-25	Hedmark	4	HED
26-29	Oppland	5	OPL
30, 33-36	Buskerud	6	BUS
30-32	Vestfold	7	VFO
37-39	Telemark	8	TEL
40-44, 55	Rogaland	9	ROG
45-47	Vest-Agder	10	VAG
48-49	Aust-Agder	11	AAG
50-54, 56, 58	Hordaland	12	HRD
57, 59, 67-69	Sogn of Fjordane	13	SFJ
60-66	Møre og Romsdal	14	MRO
70-78	Trøndelag	15	TRL
79-89	Nordland	16	NRL
90-94	Troms	17	TRO
95-99	Finmark	18	FNM
N/A	Unknown	19	UNK
Multiple	Multiple	20	MUL

Appendix 3 – Industry Categorization

Industry Categorization

This table constitutes the NACE codes and its corresponding industry as provided by SSB. The industry classifications was changed in 2009 so that pre-2009 observations are transformed to correspond to current classifications. The industries are then boradly categorized as inspired by Berzins et al. (2018), and given abbreviations respectively. Finance- and insurance businesses, public administration and defenc e, and international organizations and organs are dropped from our sample given the extraordinary CEO turnover dynamics as described in chapter 3.2 .

NACE Code	NACE Label	Industry Code	Industry Label	Abbreviation
1 - 3,223	Agriculture, forestry and fishing	1	Agriculture, forestry, fishing and mining	AFM
3,224 - 5,999 & 7,000 - 9,900	Mining and quarrying	1	Agriculture, forestry, fishing and mining	AFM
9,901 - 33,200	Manufacturing	2	Manufacturing	MFG
6,000 - 6,999	Oil	3	Energy	NRG
33,201 - 35,300	Electricity, gas, steam and air conditioning supply	3	Energy	NRG
35,301 - 39,000	Water supply: sewage, waste management and remediation activities	4	Infrastructure, construction and real estate	ICR
39,001 - 43,990	Construction	4	Infrastructure, construction and real estate	ICR
66,301 - 68,320	Real estate activities	4	Infrastructure, construction and real estate	ICR
43,991 - 47,990	Wholesale and retail trade	5	Trade	TRD
47,991 - 53,200	Transportation and storage	6	Logistics	LOG
53,201 - 56,309	Accommodation and food service activities	7	Service	SVC
56,310 - 63,990	Information and communication	7	Service	SVC
68,321 - 75,000	Professional, scientific and technical activities	7	Service	SVC
75,001 - 82,990	Administrative and support service activities	7	Service	SVC
93,300 - 96,090	Other service activities	7	Service	SVC
96,091 - 97,000	Activities of households as employers	7	Service	SVC
84,301 - 85,609	Education	8	Education, health and social	EHS
85,610 - 88,999	Human health and social work activities	8	Education, health and social	EHS
89,000 - 93,299	Arts, entertainment and recreation	9	Culture	CUL
N/A	N/A	10	Unknown	UNK
Multiple	Multiple	11	Multiple	MUL
63,991 - 66,300	Financial and insurance activities	Removed	Finance	FIN
82,991 - 84,300	Public administration and defense	Removed	Public	PUB
97,001 - 99,000	Activities of extraterritorial organizations and bodies	Removed	International organizations	INT

Appendix 4 - Hausman Test for Random versus Fixed Effects Model

	Coefficients (b) fe	(B) re	(b-B) Difference	sqrt(diag(V_b-V_B)) S.E.
roa_lag1	-.0085449	-.2422894	.2337446	.0239396
yr2001_dummy	20.06269	.3733854	19.68931	568.7607
yr2002_dummy	19.86804	.2403617	19.62768	568.7607
yr2003_dummy	19.34506	-.2743296	19.61939	568.7607
yr2004_dummy	19.74451	.1541595	19.59035	568.7607
yr2005_dummy	19.31571	-.2787496	19.59446	568.7607
yr2006_dummy	19.85202	.2456219	19.6064	568.7607
yr2007_dummy	19.7551	.1107345	19.64437	568.7607
yr2008_dummy	19.7245	.0576342	19.66686	568.7607
yr2009_dummy	19.91769	.2303949	19.6873	568.7607
yr2010_dummy	19.61106	-.0834227	19.69448	568.7607
yr2011_dummy	19.73077	.0193478	19.71142	568.7607
yr2012_dummy	19.90269	.1887533	19.71394	568.7607
yr2013_dummy	19.75482	.0108521	19.74397	568.7607
yr2014_dummy	19.7344	.0103038	19.7241	568.7607
yr2015_dummy	14.69094	-5.180458	19.8714	568.7607

```
                 b = consistent under Ho and Ha; obtained from xtlogit
  B = inconsistent under Ha, efficient under Ho; obtained from xtlogit

Test:  Ho:  difference in coefficients not systematic

              chi2(1) = (b-B)'[(V_b-V_B)^(-1)](b-B)
                      =        0.00
            Prob>chi2 =      0.9724
            (V_b-V_B is not positive definite)
```

Appendix 5 – Test of Difference in Means (t-test)

Test of difference in CEO turnover means in non-family firms (=0) and family firms (=1):

Two-sample t test with unequal variances

Group	Obs	Mean	Std. Err.	Std. Dev.	[95% Conf.	Interval]
0	156,042	.0339908	.0004587	.1812062	.0330918	.0348899
1	96,828	.0181766	.0004293	.1335903	.0173351	.019018
combined	252,870	.0279353	.0003277	.1647878	.027293	.0285776
diff		.0158143	.0006283		.0145829	.0170457

diff = mean(0) - mean(1) t = 25.1707
Ho: diff = 0 Satterthwaite's degrees of freedom = 245536

Ha: diff < 0 Ha: diff != 0 Ha: diff > 0
Pr(T < t) = 1.0000 Pr(|T| > |t|) = 0.0000 Pr(T > t) = 0.0000

Test of difference in ROA means in non-family firms (=0) and family firms (=1):

Two-sample t test with unequal variances

Group	Obs	Mean	Std. Err.	Std. Dev.	[95% Conf.	Interval]
0	182,276	.0066795	.0008529	.3641159	.0050079	.0083511
1	162,728	.0201818	.0009172	.3700021	.0183841	.0219795
combined	345,004	.0130481	.0006248	.3669654	.0118236	.0142726
diff		-.0135023	.0012525		-.015957	-.0110475

diff = mean(0) - mean(1) t = -10.7806
Ho: diff = 0 Satterthwaite's degrees of freedom = 339312

Ha: diff < 0 Ha: diff != 0 Ha: diff > 0
Pr(T < t) = 0.0000 Pr(|T| > |t|) = 0.0000 Pr(T > t) = 1.0000

Test of difference in profit dummy means in non-family firms (=0) and family firms (=1):

Two-sample t test with unequal variances

Group	Obs	Mean	Std. Err.	Std. Dev.	[95% Conf.	Interval]
0	182,973	.6205834	.0011344	.4852432	.61836	.6228068
1	163,758	.6334408	.0011908	.4818661	.6311069	.6357747
combined	346,731	.6266558	.0008214	.4836931	.6250458	.6282658
diff		-.0128574	.0016446		-.0160809	-.009634

diff = mean(0) - mean(1) t = -7.8179
Ho: diff = 0 Satterthwaite's degrees of freedom = 343017

Ha: diff < 0 Ha: diff != 0 Ha: diff > 0
Pr(T < t) = 0.0000 Pr(|T| > |t|) = 0.0000 Pr(T > t) = 1.0000

Test of difference in revenue means in non-family firms (=0) and family firms (=1):

Two-sample t test with unequal variances

Group	Obs	Mean	Std. Err.	Std. Dev.	[95% Conf.	Interval]
0	182,973	5486257	47521.24	2.03e+07	5393117	5579398
1	163,758	3242473	24676.47	9985834	3194108	3290838
combined	346,731	4426538	27718.56	1.63e+07	4372210	4480865
diff		2243784	53546.21		2138835	2348733

```
    diff = mean(0) - mean(1)                                      t =  41.9037
Ho: diff = 0                     Satterthwaite's degrees of freedom =   272789

    Ha: diff < 0                 Ha: diff != 0                 Ha: diff > 0
 Pr(T < t) = 1.0000         Pr(|T| > |t|) = 0.0000          Pr(T > t) = 0.0000
```

Test of difference in net income means in non-family firms (=0) and family firms (=1):

Two-sample t test with unequal variances

Group	Obs	Mean	Std. Err.	Std. Dev.	[95% Conf.	Interval]
0	182,973	182691.8	40006.48	1.71e+07	104280.1	261103.6
1	163,758	270935.4	13294.09	5379722	244879.3	296991.5
combined	346,731	224368.5	22025.73	1.30e+07	181198.7	267538.3
diff		-88243.58	42157.46		-170871.1	-5616.037

```
    diff = mean(0) - mean(1)                                      t =  -2.0932
Ho: diff = 0                     Satterthwaite's degrees of freedom =   222579

    Ha: diff < 0                 Ha: diff != 0                 Ha: diff > 0
 Pr(T < t) = 0.0182         Pr(|T| > |t|) = 0.0363          Pr(T > t) = 0.9818
```

Test of difference in operating income means in non-family firms (=0) and family firms (=1):

Two-sample t test with unequal variances

Group	Obs	Mean	Std. Err.	Std. Dev.	[95% Conf.	Interval]
0	182,973	328500.7	40661.73	1.74e+07	248804.7	408196.7
1	163,758	274686.9	7317.574	2961204	260344.6	289029.2
combined	346,731	303084.9	21734.11	1.28e+07	260486.7	345683.1
diff		53813.81	41314.92		-27162.46	134790.1

```
    diff = mean(0) - mean(1)                                      t =   1.3025
Ho: diff = 0                     Satterthwaite's degrees of freedom =   194787

    Ha: diff < 0                 Ha: diff != 0                 Ha: diff > 0
 Pr(T < t) = 0.9036         Pr(|T| > |t|) = 0.1927          Pr(T > t) = 0.0964
```

Test of difference in other interest expense means in non-family firms (=0) and family firms (=1):

Two-sample t test with unequal variances

Group	Obs	Mean	Std. Err.	Std. Dev.	[95% Conf.	Interval]
0	182,973	-75270.92	1667.656	713345.7	-78539.49	-72002.35
1	163,758	-44781.27	502.3143	203271.6	-45765.8	-43796.75
combined	346,731	-60870.93	911.8186	536914.1	-62658.06	-59083.79
diff		-30489.65	1741.665		-33903.27	-27076.03

```
    diff = mean(0) - mean(1)                                     t = -17.5060
Ho: diff = 0                     Satterthwaite's degrees of freedom =   215695

    Ha: diff < 0                 Ha: diff != 0                 Ha: diff > 0
 Pr(T < t) = 0.0000         Pr(|T| > |t|) = 0.0000          Pr(T > t) = 1.0000
```

Test of difference in CEO age means in non-family firms (=0) and family firms (=1):

Two-sample t test with unequal variances

Group	Obs	Mean	Std. Err.	Std. Dev.	[95% Conf.	Interval]
0	156,042	46.869	.0272418	10.7611	46.81561	46.9224
1	96,828	48.87521	.0397266	12.36179	48.79735	48.95308
combined	252,870	47.63721	.0227542	11.44222	47.59262	47.68181
diff		-2.006208	.0481697		-2.10062	-1.911797

```
    diff = mean(0) - mean(1)                                     t = -41.6488
Ho: diff = 0                     Satterthwaite's degrees of freedom =   184046

    Ha: diff < 0                 Ha: diff != 0                 Ha: diff > 0
 Pr(T < t) = 0.0000         Pr(|T| > |t|) = 0.0000          Pr(T > t) = 1.0000
```

Test of difference in CEO tenure means in non-family firms (=0) and family firms (=1):

Two-sample t test with unequal variances

Group	Obs	Mean	Std. Err.	Std. Dev.	[95% Conf.	Interval]
0	156,042	3.968925	.0098321	3.8839	3.949654	3.988196
1	96,828	4.324854	.013163	4.095969	4.299055	4.350654
combined	252,870	4.105216	.0078952	3.970208	4.089742	4.120691
diff		-.3559293	.0164297		-.3881312	-.3237275

```
    diff = mean(0) - mean(1)                                     t = -21.6637
Ho: diff = 0                     Satterthwaite's degrees of freedom =   196968

    Ha: diff < 0                 Ha: diff != 0                 Ha: diff > 0
 Pr(T < t) = 0.0000         Pr(|T| > |t|) = 0.0000          Pr(T > t) = 1.0000
```

Test of difference in CEO ownership means in non-family firms (=0) and family firms (=1):

Two-sample t test with unequal variances

Group	Obs	Mean	Std. Err.	Std. Dev.	[95% Conf.	Interval]
0	116,806	39.19377	.0378791	12.94591	39.11953	39.26801
1	67,165	40.06582	.0479253	12.42042	39.97188	40.15975
combined	183,971	39.51214	.0297573	12.76344	39.45382	39.57047
diff		-.8720461	.0610873		-.991776	-.7523161

```
    diff = mean(0) - mean(1)                                      t = -14.2754
Ho: diff = 0                     Satterthwaite's degrees of freedom =   144797

    Ha: diff < 0                 Ha: diff != 0                 Ha: diff > 0
 Pr(T < t) = 0.0000         Pr(|T| > |t|) = 0.0000          Pr(T > t) = 1.0000
```

Test of difference in family CEO means in non-family firms (=0) and family firms (=1):

Two-sample t test with unequal variances

Group	Obs	Mean	Std. Err.	Std. Dev.	[95% Conf.	Interval]
0	182,973	.3672126	.0011269	.4820465	.3650039	.3694214
1	163,758	.5031937	.0012356	.4999913	.5007721	.5056154
combined	346,731	.4314353	.0008411	.4952773	.4297868	.4330839
diff		-.1359811	.0016723		-.1392587	-.1327034

```
    diff = mean(0) - mean(1)                                      t = -81.3143
Ho: diff = 0                     Satterthwaite's degrees of freedom =   339355

    Ha: diff < 0                 Ha: diff != 0                 Ha: diff > 0
 Pr(T < t) = 0.0000         Pr(|T| > |t|) = 0.0000          Pr(T > t) = 1.0000
```

Test of difference in CEO gender means in non-family firms (=0) and family firms (=1):

Two-sample t test with unequal variances

Group	Obs	Mean	Std. Err.	Std. Dev.	[95% Conf.	Interval]
0	156,041	.8056472	.0010017	.3957029	.8036839	.8076106
1	96,819	.7227507	.0014386	.4476429	.719931	.7255704
combined	252,860	.7739065	.0008319	.4183012	.7722761	.7755369
diff		.0828965	.001753		.0794606	.0863324

```
    diff = mean(0) - mean(1)                                      t =  47.2874
Ho: diff = 0                     Satterthwaite's degrees of freedom =   186288

    Ha: diff < 0                 Ha: diff != 0                 Ha: diff > 0
 Pr(T < t) = 1.0000         Pr(|T| > |t|) = 0.0000          Pr(T > t) = 0.0000
```

Test of difference in board size means in non-family firms (=0) and family firms (=1):

Two-sample t test with unequal variances

Group	Obs	Mean	Std. Err.	Std. Dev.	[95% Conf.	Interval]
0	180,112	2.93433	.0032032	1.359412	2.928052	2.940608
1	157,302	1.859188	.0026638	1.056479	1.853967	1.864409
combined	337,414	2.4331	.0023061	1.339578	2.42858	2.43762
diff		1.075142	.004166		1.066976	1.083307

```
    diff = mean(0) - mean(1)                                      t = 258.0731
Ho: diff = 0                         Satterthwaite's degrees of freedom =   333008

    Ha: diff < 0                 Ha: diff != 0                 Ha: diff > 0
 Pr(T < t) = 1.0000         Pr(|T| > |t|) = 0.0000          Pr(T > t) = 0.0000
```

Test of difference in family members on board means in non-family firms (=0) and family firms (=1):

Two-sample t test with unequal variances

Group	Obs	Mean	Std. Err.	Std. Dev.	[95% Conf.	Interval]
0	182,973	.9061228	.0011877	.5080322	.9037949	.9084506
1	163,758	1.570934	.0024025	.9722341	1.566225	1.575643
combined	346,731	1.220107	.0014135	.8323345	1.217337	1.222878
diff		-.6648112	.0026801		-.670064	-.6595583

```
    diff = mean(0) - mean(1)                                      t = -2.5e+02
Ho: diff = 0                         Satterthwaite's degrees of freedom =   240707

    Ha: diff < 0                 Ha: diff != 0                 Ha: diff > 0
 Pr(T < t) = 0.0000         Pr(|T| > |t|) = 0.0000          Pr(T > t) = 1.0000
```

Test of difference in firm age means in non-family firms (=0) and family firms (=1):

Two-sample t test with unequal variances

Group	Obs	Mean	Std. Err.	Std. Dev.	[95% Conf.	Interval]
0	173,961	9.248291	.0286597	11.95356	9.192119	9.304464
1	157,428	10.53988	.0276982	10.98985	10.4856	10.59417
combined	331,389	9.861869	.0200184	11.52386	9.822634	9.901105
diff		-1.291594	.0398568		-1.369712	-1.213475

```
    diff = mean(0) - mean(1)                                      t = -32.4059
Ho: diff = 0                         Satterthwaite's degrees of freedom =   331304

    Ha: diff < 0                 Ha: diff != 0                 Ha: diff > 0
 Pr(T < t) = 0.0000         Pr(|T| > |t|) = 0.0000          Pr(T > t) = 1.0000
```

Test of difference in employees means in non-family firms (=0) and family firms (=1):

Two-sample t test with unequal variances

Group	Obs	Mean	Std. Err.	Std. Dev.	[95% Conf.	Interval]
0	134,400	6.011131	.0282956	10.37335	5.955672	6.06659
1	123,966	4.274245	.0210902	7.425591	4.232908	4.315581
combined	258,366	5.177759	.0179434	9.120578	5.142591	5.212928
diff		1.736886	.0352907		1.667717	1.806055

diff = mean(0) - mean(1) t = 49.2165
Ho: diff = 0 Satterthwaite's degrees of freedom = 243673

Ha: diff < 0 Ha: diff != 0 Ha: diff > 0
Pr(T < t) = 1.0000 Pr(|T| > |t|) = 0.0000 Pr(T > t) = 0.0000

Test of difference in number of firms in the industry means in non-family firms (=0) and family firms (=1):

Two-sample t test with unequal variances

Group	Obs	Mean	Std. Err.	Std. Dev.	[95% Conf.	Interval]
0	182,973	5389.153	6.394505	2735.271	5376.62	5401.686
1	163,758	4086.326	4.520924	1829.483	4077.465	4095.187
combined	346,731	4773.839	4.143175	2439.662	4765.719	4781.96
diff		1302.826	7.831248		1287.477	1318.176

diff = mean(0) - mean(1) t = 166.3626
Ho: diff = 0 Satterthwaite's degrees of freedom = 321776

Ha: diff < 0 Ha: diff != 0 Ha: diff > 0
Pr(T < t) = 1.0000 Pr(|T| > |t|) = 0.0000 Pr(T > t) = 0.0000

Test of difference in number of firms in the region means in non-family firms (=0) and family firms (=1):

Two-sample t test with unequal variances

Group	Obs	Mean	Std. Err.	Std. Dev.	[95% Conf.	Interval]
0	182,973	3833.674	4.955159	2119.586	3823.963	3843.386
1	163,758	3196.641	4.481301	1813.449	3187.857	3205.424
combined	346,731	3532.809	3.407162	2006.269	3526.131	3539.487
diff		637.0339	6.680992		623.9394	650.1285

diff = mean(0) - mean(1) t = 95.3502
Ho: diff = 0 Satterthwaite's degrees of freedom = 346034

Ha: diff < 0 Ha: diff != 0 Ha: diff > 0
Pr(T < t) = 1.0000 Pr(|T| > |t|) = 0.0000 Pr(T > t) = 0.0000

Appendix 6 – Test of Difference in Medians (Wilcoxon Rank-Sum Test)

Test of difference in medians in non-family firms (=0) and family firms (=1).

(1) Turnover:

```
Two-sample Wilcoxon rank-sum (Mann-Whitney) test

   fam_dummy |      obs    rank sum    expected
-------------+---------------------------------
           0 |  1.6e+05  1.985e+10   1.973e+10
           1 |    96828  1.212e+10   1.224e+10
-------------+---------------------------------
    combined |  2.5e+05  3.197e+10   3.197e+10

unadjusted variance   3.184e+14
adjustment for ties  -2.925e+14
                     ----------
adjusted variance     2.594e+13

Ho: turnover(fam_du~y==0) = turnover(fam_du~y==1
             z =  23.458
    Prob > |z| =   0.0000
```

(2) ROA:

```
Two-sample Wilcoxon rank-sum (Mann-Whitney) test

   fam_dummy |      obs    rank sum    expected
-------------+---------------------------------
           0 |  1.8e+05  3.117e+10   3.144e+10
           1 |  1.6e+05  2.834e+10   2.807e+10
-------------+---------------------------------
    combined |  3.5e+05  5.951e+10   5.951e+10

unadjusted variance   8.528e+14
adjustment for ties  -5.725e+09
                     ----------
adjusted variance     8.528e+14

Ho: roawinz(fam_du~y==0) = roawinz(fam_du~y==1)
             z =  -9.182
    Prob > |z| =   0.0000
```

(3) Profit dummy:

```
Two-sample Wilcoxon rank-sum (Mann-Whitney) test

   fam_dummy |      obs    rank sum    expected
-------------+---------------------------------
           0 |  1.8e+05  3.153e+10   3.172e+10
           1 |  1.6e+05  2.858e+10   2.839e+10
-------------+---------------------------------
    combined |  3.5e+05  6.011e+10   6.011e+10

unadjusted variance   8.658e+14
adjustment for ties  -2.581e+14
                     ----------
adjusted variance     6.077e+14

Ho: profit~y(fam_du~y==0) = profit~y(fam_du~y==1
             z =  -7.814
    Prob > |z| =   0.0000
```

(4) Revenue:

```
Two-sample Wilcoxon rank-sum (Mann-Whitney) test

   fam_dummy |      obs    rank sum    expected
-------------+---------------------------------
           0 |  1.8e+05  3.375e+10   3.172e+10
           1 |  1.6e+05  2.636e+10   2.839e+10
-------------+---------------------------------
    combined |  3.5e+05  6.011e+10   6.011e+10

unadjusted variance   8.658e+14
adjustment for ties  -4.289e+12
                     ----------
adjusted variance     8.615e+14

Ho: rev(fam_du~y==0) = rev(fam_du~y==1)
             z =  69.091
    Prob > |z| =   0.0000
```

(5) Net income:

```
Two-sample Wilcoxon rank-sum (Mann-Whitney) test

   fam_dummy |      obs    rank sum    expected
-------------+---------------------------------
           0 |  1.8e+05  3.150e+10   3.172e+10
           1 |  1.6e+05  2.861e+10   2.839e+10
-------------+---------------------------------
    combined |  3.5e+05  6.011e+10   6.011e+10

unadjusted variance   8.658e+14
adjustment for ties  -2.064e+09
                     ----------
adjusted variance     8.658e+14

Ho: ni(fam_du~y==0) = ni(fam_du~y==1)
             z =  -7.478
    Prob > |z| =   0.0000
```

(6) Operating income

```
Two-sample Wilcoxon rank-sum (Mann-Whitney) test

   fam_dummy |      obs    rank sum    expected
-------------+---------------------------------
           0 |  1.8e+05  3.225e+10   3.172e+10
           1 |  1.6e+05  2.786e+10   2.839e+10
-------------+---------------------------------
    combined |  3.5e+05  6.011e+10   6.011e+10

unadjusted variance   8.658e+14
adjustment for ties  -2.019e+09
                     ----------
adjusted variance     8.658e+14

Ho: operinc(fam_du~y==0) = operinc(fam_du~y==1)
             z =  17.877
    Prob > |z| =   0.0000
```

(7) Other interest expenses:

```
Two-sample Wilcoxon rank-sum (Mann-Whitney) test

   fam_dummy |      obs    rank sum    expected
-------------+---------------------------------
           0 |  1.8e+05   3.109e+10   3.172e+10
           1 |  1.6e+05   2.902e+10   2.839e+10
-------------+---------------------------------
    combined |  3.5e+05   6.011e+10   6.011e+10

unadjusted variance   8.658e+14
adjustment for ties  -4.394e+13
                     ----------
adjusted variance     8.218e+14

Ho: otherie(fam_du~y==0) = otherie(fam_du~y==1)
             z = -21.892
    Prob > |z| =   0.0000
```

(8) CEO age:

```
Two-sample Wilcoxon rank-sum (Mann-Whitney) test

   fam_dummy |      obs    rank sum    expected
-------------+---------------------------------
           0 |  1.6e+05   1.903e+10   1.973e+10
           1 |    96828   1.294e+10   1.224e+10
-------------+---------------------------------
    combined |  2.5e+05   3.197e+10   3.197e+10

unadjusted variance   3.184e+14
adjustment for ties  -2.052e+11
                     ----------
adjusted variance     3.182e+14

Ho: ceo_age(fam_du~y==0) = ceo_age(fam_du~y==1)
             z = -38.970
    Prob > |z| =   0.0000
```

(9) CEO tenure:

```
Two-sample Wilcoxon rank-sum (Mann-Whitney) test

   fam_dummy |      obs    rank sum    expected
-------------+---------------------------------
           0 |  1.6e+05   1.938e+10   1.973e+10
           1 |    96828   1.259e+10   1.224e+10
-------------+---------------------------------
    combined |  2.5e+05   3.197e+10   3.197e+10

unadjusted variance   3.184e+14
adjustment for ties  -4.265e+12
                     ----------
adjusted variance     3.141e+14

Ho: ceo_te~e(fam_du~y==0) = ceo_te~e(fam_du~y==1
             z = -19.636
    Prob > |z| =   0.0000
```

(10) CEO ownership:

```
Two-sample Wilcoxon rank-sum (Mann-Whitney) test

   fam_dummy |      obs    rank sum    expected
-------------+---------------------------------
           0 |  1.2e+05   1.068e+10   1.074e+10
           1 |    67165   6.239e+09   6.178e+09
-------------+---------------------------------
    combined |  1.8e+05   1.692e+10   1.692e+10

unadjusted variance   1.203e+14
adjustment for ties  -1.442e+13
                     ----------
adjusted variance     1.059e+14

Ho: ceo_own(fam_du~y==0) = ceo_own(fam_du~y==1)
             z =  -5.890
    Prob > |z| =   0.0000
```

(11) Family CEO:

```
Two-sample Wilcoxon rank-sum (Mann-Whitney) test

   fam_dummy |      obs    rank sum    expected
-------------+---------------------------------
           0 |  1.8e+05   2.968e+10   3.172e+10
           1 |  1.6e+05   3.043e+10   2.839e+10
-------------+---------------------------------
    combined |  3.5e+05   6.011e+10   6.011e+10

unadjusted variance   8.658e+14
adjustment for ties  -2.287e+14
                     ----------
adjusted variance     6.371e+14

Ho: fam_ceo(fam_du~y==0) = fam_ceo(fam_du~y==1)
             z = -80.710
    Prob > |z| =   0.0000
```

(12): CEO gender:

```
Two-sample Wilcoxon rank-sum (Mann-Whitney) test

   fam_dummy |      obs    rank sum    expected
-------------+---------------------------------
           0 |  1.6e+05   2.035e+10   1.973e+10
           1 |    96819   1.161e+10   1.224e+10
-------------+---------------------------------
    combined |  2.5e+05   3.197e+10   3.197e+10

unadjusted variance   3.183e+14
adjustment for ties  -1.512e+14
                     ----------
adjusted variance     1.671e+14

Ho: gender(fam_du~y==0) = gender(fam_du~y==1)
             z =  48.440
    Prob > |z| =   0.0000
```

(13) Total assets:

```
Two-sample Wilcoxon rank-sum (Mann-Whitney) test

   fam_dummy |      obs    rank sum    expected
-------------+---------------------------------
           0 |  1.8e+05   3.227e+10   3.172e+10
           1 |  1.6e+05   2.784e+10   2.839e+10
-------------+---------------------------------
    combined |  3.5e+05   6.011e+10   6.011e+10

unadjusted variance   8.658e+14
adjustment for ties  -1.078e+08
                     ----------
adjusted variance     8.658e+14

Ho: t_assets(fam_du~y==0) = t_assets(fam_du~y==1)
             z =  18.698
    Prob > |z| =   0.0000
```

(14) Board size:

```
Two-sample Wilcoxon rank-sum (Mann-Whitney) test

   fam_dummy |      obs    rank sum    expected
-------------+---------------------------------
           0 |  1.8e+05   3.708e+10   3.039e+10
           1 |  1.6e+05   1.984e+10   2.654e+10
-------------+---------------------------------
    combined |  3.4e+05   5.692e+10   5.692e+10

unadjusted variance   7.966e+14
adjustment for ties  -4.964e+13
                     ----------
adjusted variance     7.470e+14

Ho: board_~e(fam_du~y==0) = board_~e(fam_du~y==1
             z = 244.987
    Prob > |z| =   0.0000
```

(15) N fam. members on board:

```
Two-sample Wilcoxon rank-sum (Mann-Whitney) test

   fam_dummy |      obs    rank sum    expected
-------------+---------------------------------
           0 |   1.8e+05  2.585e+10   3.172e+10
           1 |   1.6e+05  3.426e+10   2.839e+10
-------------+---------------------------------
    combined |   3.5e+05  6.011e+10   6.011e+10

unadjusted variance    8.658e+14
adjustment for ties   -2.395e+14
                      ----------
adjusted variance      6.263e+14

Ho: fam_bo~d(fam_du~y==0) = fam_bo~d(fam_du~y==1
             z = -234.706
    Prob > |z| =   0.0000
```

(16) Firm age:

```
Two-sample Wilcoxon rank-sum (Mann-Whitney) test

   fam_dummy |      obs    rank sum    expected
-------------+---------------------------------
           0 |   1.7e+05  2.723e+10   2.882e+10
           1 |   1.6e+05  2.768e+10   2.609e+10
-------------+---------------------------------
    combined |   3.3e+05  5.491e+10   5.491e+10

unadjusted variance    7.563e+14
adjustment for ties   -2.578e+12
                      ----------
adjusted variance      7.537e+14

Ho: firm_age(fam_du~y==0) = firm_age(fam_du~y==1
             z = -58.019
    Prob > |z| =   0.0000
```

(17) Number of employees:

```
Two-sample Wilcoxon rank-sum (Mann-Whitney) test

   fam_dummy |      obs    rank sum    expected
-------------+---------------------------------
           0 |   1.3e+05  1.884e+10   1.736e+10
           1 |   1.2e+05  1.454e+10   1.601e+10
-------------+---------------------------------
    combined |   2.6e+05  3.338e+10   3.338e+10

unadjusted variance    3.587e+14
adjustment for ties   -4.977e+12
                      ----------
adjusted variance      3.537e+14

Ho: employ~s(fam_du~y==0) = employ~s(fam_du~y==1)
             z =  78.363
    Prob > |z| =   0.0000
```

(18) Number of firms in the industry:

```
Two-sample Wilcoxon rank-sum (Mann-Whitney) test

   fam_dummy |      obs    rank sum    expected
-------------+---------------------------------
           0 |   1.8e+05  3.677e+10   3.172e+10
           1 |   1.6e+05  2.334e+10   2.839e+10
-------------+---------------------------------
    combined |   3.5e+05  6.011e+10   6.011e+10

unadjusted variance    8.658e+14
adjustment for ties   -9.055e+12
                      ----------
adjusted variance      8.567e+14

Ho: num_ind(fam_du~y==0) = num_ind(fam_du~y==1)
             z = 172.634
    Prob > |z| =   0.0000
```

(19) Number of firms in the region:

```
Two-sample Wilcoxon rank-sum (Mann-Whitney) test

   fam_dummy |      obs    rank sum    expected
-------------+---------------------------------
           0 |   1.8e+05  3.448e+10   3.172e+10
           1 |   1.6e+05  2.563e+10   2.839e+10
-------------+---------------------------------
    combined |   3.5e+05  6.011e+10   6.011e+10

unadjusted variance    8.658e+14
adjustment for ties   -5.340e+12
                      ----------
adjusted variance      8.604e+14

Ho: num_loc(fam_du~y==0) = num_loc(fam_du~y==1)
             z =  94.045
    Prob > |z| =   0.0000
```

Appendix 7 – Test for Autocorrelation

```
Wooldridge test for autocorrelation in panel data
H0: no first order autocorrelation
    F(  1,    51806) =      85.553
           Prob > F =      0.0000
```

Appendix 8 – Correlation Matrix

Correlation Matrix

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
(1) Turnover	1,000													
(2) ROA	-0,012	1,000												
(3) Profit dummy	-0,009	0,592	1,000											
(4) Family CEO	-0,035	-0,007	-0,007	1,000										
(5) Family firm dummy	-0,039	-0,002	-0,006	0,448	1,000									
(6) ln(revenue)	0,026	0,193	0,231	-0,038	-0,060	1,000								
(7) ln(firm age)	-0,008	0,120	0,147	0,057	0,121	0,177	1,000							
(8) CEO age	0,013	0,053	0,061	0,076	0,115	-0,033	0,408	1,000						
(9) CEO ownership	-0,061	0,005	-0,008	0,156	0,030	-0,061	-0,113	-0,069	1,000					
(10) ln(CEO tenure)	-0,036	0,093	0,117	0,032	0,048	0,155	0,692	0,341	-0,001	1,000				
(11) ln(number of firms in region)	0,001	0,003	-0,001	-0,062	-0,130	-0,002	-0,009	-0,020	-0,022	-0,004	1,000			
(12) Board size	0,061	0,002	0,016	-0,156	-0,193	0,114	0,051	0,017	-0,516	0,013	0,026	1,000		
(13) Number of family members on board	-0,021	0,007	0,008	0,313	0,583	-0,012	0,109	0,084	-0,098	0,053	-0,084	0,330	1,000	
(14) Industry return	0,017	0,016	0,031	-0,056	-0,086	-0,072	-0,056	-0,044	-0,007	-0,022	0,039	0,016	-0,084	1,000

Appendix 9 – Propensity Score Matching on Family and Non-Family Firms

```
Logistic regression                             Number of obs     =    132,228
                                                LR chi2(8)        =    6183.04
                                                Prob > chi2       =     0.0000
Log likelihood =  -83617.88                     Pseudo R2         =     0.0357
```

fam_dummy	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
roa_lag1	.0284636	.0176683	1.61	0.107	-.0061656	.0630927
profit_dummy_lag1	-.0506778	.0146949	-3.45	0.001	-.0794791	-.0218764
ln_rev	-.0873004	.0035937	-24.29	0.000	-.0943439	-.0802569
ln_firm_age	.3527708	.0086277	40.89	0.000	.3358608	.3696808
ceo_age	.0144282	.0005931	24.33	0.000	.0132658	.0155907
ceo_own_lag1	.0079518	.0004783	16.63	0.000	.0070144	.0088893
ln_ceo_tenure	-.196129	.0097453	-20.13	0.000	-.2152293	-.1770286
ln_num_loc	-.3665284	.0078981	-46.41	0.000	-.3820083	-.3510485
_cons	2.23555	.0895978	24.95	0.000	2.059942	2.411159

Variable	Sample	Treated	Controls	Difference	S.E.	T-stat
turnover	Unmatched	.018941597	.032159848	-.013218251	.000931388	-14.19
	ATT	.018941597	.031548559	-.012606962	.001295475	-9.73

Note: S.E. does not take into account that the propensity score is estimated.

psmatch2: Treatment assignment	psmatch2: Common support On suppor	Total
Untreated	84,080	84,080
Treated	48,148	48,148
Total	132,228	132,228

Appendix 10 – Chi Square Test of Difference between Turnover in Family Firms and Turnover in Non-Family Firms Coefficients

```
 ( 1)  turnover_fam - turnover_nonfam = 0

           chi2(  1) =    1.20
         Prob > chi2 =    0.2726
```

Appendix 11 – Adding Delta ROA as an Additional Performance Measure

CEO Turnover to Performance Sensitivity using ROA and Delta ROA

*This table provides the results of regression model 2A-B assessing the difference in CEO turnover between non-family firms and family firms. Panel A and B constitute regression 2A, while panel C constitutes regression 2B results including family CEO dummy variable for family firms. The marginal effect for dummy variables is defined as the discrete change from 0 to 1. Definitions of all variables can be found in Chapter 4.2. All NOK values are in 2015 NOKs. Year and industry fixed effects are incorporated in the model. Robust standard errors (SE) were applied to account for potential heteroskedasticity. *, **, and *** imply significance at the 10%, 5%, and 1% levels respectively.*

Dep. var.: CEO turnover	Panel A: Non-Family Firms			Panel B: Family Firms			Panel C: Family Firms		
				Excl. family CEO dummy			Incl. family CEO dummy		
Variables	Odds Ratio	Marginal effects	Robust SE	Odds Ratio	Marginal effects	Robust SE	Odds Ratio	Marginal effects	Robust SE
Constant	0,012***		0,005	0,002***		0,001	0,002***		0,002
ROA	0,883	-0,004	0,070	0,680***	-0,007	0,077	0,691***	-0,007	0,078
Delta ROA	0,891*	-0,003	0,056	0,984	-0,000	0,094	0,994	-0,000	0,096
Profit dummy	0,894*	-0,003	0,052	0,974	-0,000	0,090	0,975	-0,000	0,091
Family CEO dummy							0,563***	-0,013	0,073
ln(revenue)	1,117***	0,003	0,018	1,217***	0,004	0,036	0,209***	0,003	0,035
ln(firm age)	1,016	0,000	0,039	0,925	-0,001	0,056	0,929	-0,001	0,056
CEO age	1,021***	0,000	0,003	1,027***	0,000	0,004	0,029***	0,001	0,004
CEO ownership	0,974***	-0,000	0,002	0,986***	-0,000	0,003	0,989***	-0,000	0,003
ln(CEO tenure)	0,750***	-0,008	0,043	0,735***	-0,006	0,0725	0,739***	-0,005	0,074
ln(number of firms in region)	0,972	-0,000	0,030	0,974	-0,000	0,0495	0,975	-0,000	0,050
Year fixed effects		Yes			Yes			Yes	
Industry fixed effects		Yes			Yes			Yes	
Number of observations		59 893			35 345			35 345	

Difference in CEO Turnover Sensitivity to Performance using ROA and Delta ROA

*This table provides the results of regression model 3A-C assessing the marginal effect of performance sensitivity in family firms on CEO turnover versus non-family. Panel A constitutes regression 3A with family firm dummy variable included. Panel B presents the results of regression 3B including interaction terms on performance. Panel C provides the results of regression 3C incorporating interaction terms on all variables of firm characteristics. The marginal effect for dummy variables is defined as the discrete change from 0 to 1. Definitions of all variables can be found in Chapter 4.2. All NOK values are in 2015 NOKs. Year and industry fixed effects are incorporated in the model. Robust standard errors (SE) were applied to account for potential heteroskedasticity. *, **, and *** imply significance at the 10%, 5%, and 1% levels respectively.*

Dep. var.: CEO turnover	Panel A: Full Sample			Panel B: Full Sample			Panel C: Full Sample		
	Excl. interaction terms			Incl. inter. terms on performance			Incl. inter. terms on all firm var.		
Variables	Odds Ratio	Marginal effects	Robust SE	Odds Ratio	Marginal effects	Robust SE	Odds Ratio	Marginal effects	Robust SE
Constant	0,008***		0,003	0,008***		0,003	0,011***		0,004
Family firm dummy	0,603***	-0,012	0,272	0,560***	-0,014	0,048	0,206***	-0,035	0,094
ROA * Family firm dummy				0,823	-0,005	0,112	0,789*	-0,006	0,108
Delta ROA * Family firm dummy				1,134	0,003	0,126	1,111	0,003	0,125
Profit dummy * Family firm dummy				1,121	0,003	0,120	1,085	0,002	0,118
ln(revenues) * Family firm dummy							1,085***	0,002	0,034
ln(firm age) * Family firm dummy							0,919*	-0,002	0,047
ROA	0,813***	-0,005	0,054	0,864*	-0,003	0,069	0,875*	-0,003	0,070
Delta ROA	0,909*	-0,002	0,049	0,883**	-0,003	0,055	0,890*	-0,003	0,056
Profit dummy	0,918*	-0,002	0,045	0,892**	-0,003	0,051	0,900*	-0,003	0,051
ln(revenue)	1,145***	0,003	0,016	1,146***	0,003	0,017	1,121***	0,003	0,018
ln(firm age)	0,999	-0,000	0,032	0,999	-0,000	0,032	1,021	0,001	0,036
CEO age	1,023***	0,001	0,002	1,023***	0,001	0,002	1,023***	0,001	0,002
CEO ownership	0,977***	-0,001	0,001	0,9778***	-0,001	0,001	0,978***	-0,001	0,001
ln(CEO tenure)	0,728***	-0,008	0,035	0,727***	-0,008	0,035	0,727***	-0,008	0,035
ln(number of firms in region)	0,973	-0,001	0,026	0,971	-0,001	0,026	0,972	-0,001	0,026
Year fixed effects		Yes			Yes			Yes	
Industry fixed effects		Yes			Yes			Yes	
Number of observations		95 326			95 218			95 218	

Appendix 12 – Substituting Lagged ROA for Delta ROA

CEO Turnover to Performance Sensitivity using Delta ROA

*This table provides the results of regression model 2A-B assessing the difference in CEO turnover between non-family firms and family firms. Panel A and B constitute regression 2A, while panel C constitutes regression 2B results including family CEO dummy variable for family firms. The marginal effect for dummy variables is defined as the discrete change from 0 to 1. Definitions of all variables can be found in Chapter 4.2. All NOK values are in 2015 NOKs. Year and industry fixed effects are incorporated in the model. Robust standard errors (SE) were applied to account for potential heteroskedasticity. *, **, and *** imply significance at the 10%, 5%, and 1% levels respectively.*

Dep. var.: CEO turnover	Panel A: Non-Family Firms			Panel B: Family Firms			Panel C: Family Firms		
				Excl. family CEO dummy			Incl. family CEO dummy		
Variables	Odds Ratio	Marginal effects	Robust SE	Odds Ratio	Marginal effects	Robust SE	Odds Ratio	Marginal effects	Robust SE
Constant	0,013***		0,005	0,002***		0,001	0,003***		0,002
Delta ROA	0,935	-0,002	0,053	1,223*	0,004	0,142	1,224*	0,004	0,141
Profit dummy	0,865***	-0,004	0,046	0,893	-0,002	0,077	0,897	-0,002	0,078
Family CEO dummy							0,559***	-0,013	0,073
ln(revenue)	1,115***	0,003	0,018	1,207***	0,003	0,035	1,199***	0,003	0,035
ln(firm age)	1,014	0,000	0,039	0,922	-0,001	0,056	0,925	-0,001	0,056
CEO age	1,022***	0,001	0,003	1,027***	0,000	0,004	1,029***	0,001	0,004
CEO ownership	0,974***	-0,001	0,002	0,986***	-0,000	0,003	0,989***	-0,000	0,003
ln(CEO tenure)	0,748***	-0,008	0,043	0,732***	-0,006	0,072	0,737***	-0,005	0,073
ln(number of firms in region)	0,972	-0,001	0,030	0,974	-0,000	0,049	0,974	-0,000	0,049
Year fixed effects		Yes			Yes			Yes	
Industry fixed effects		Yes			Yes			Yes	
Number of observations		59 893			35 345			35 345	

Difference in CEO Turnover Sensitivity to Performance using Delta ROA

*This table provides the results of regression model 3A-C assessing the marginal effect of performance sensitivity in family firms on CEO turnover versus non-family. Panel A constitutes regression 3A with family firm dummy variable included. Panel B presents the results of regression 3B including interaction terms on performance. Panel C provides the results of regression 3C incorporating interaction terms on all variables of firm characteristics. The marginal effect for dummy variables is defined as the discrete change from 0 to 1. Definitions of all variables can be found in Chapter 4.2. All NOK values are in 2015 NOKs. Year and industry fixed effects are incorporated in the model. Robust standard errors (SE) were applied to account for potential heteroskedasticity. *, **, and *** imply significance at the 10%, 5%, and 1% levels respectively.*

Dep. var.: CEO turnover	Panel A: Full Sample			Panel B: Full Sample			Panel C: Full Sample		
	Excl. interaction terms			Incl. inter. terms on performance			Incl. inter. terms on all firm var.		
Variables	Odds Ratio	Marginal effects	Robust SE	Odds Ratio	Marginal effects	Robust SE	Odds Ratio	Marginal effects	Robust SE
Constant	0,009***		0,003	0,008***		0,003	0,011***		0,004
Family firm dummy	0,602***	-0,012	0,027	0,565***	-0,013	0,047	0,241***	-0,031	0,112
Delta ROA * Family firm dummy				1,242*	0,005	0,151	1,242*	0,005	0,156
Profit dummy * Family firm dummy				1,080	0,002	0,106	1,043	0,001	0,105
ln(revenue) * Family firm dummy							1,081**	0,002	0,034
ln(firm age) * Family firm dummy							0,914	-0,002	0,047
Delta ROA	0,992	0,000	0,053	0,931	-0,002	0,056	0,932	-0,002	0,056
Profit dummy	0,871***	-0,004	0,039	0,839***	-0,004	0,045	0,848***	-0,004	0,046
ln(revenue)	1,139***	0,003	0,016	1,150***	0,003	0,017	1,128***	0,003	0,018
ln(firm age)	0,996	0,000	0,032	0,988	0,000	0,036	1,013	0,000	0,040
CEO age	1,023***	0,001	0,002	1,024***	0,001	0,002	1,024***	0,001	0,002
CEO ownership	0,977***	-0,001	0,001	0,977***	-0,001	0,001	0,977***	-0,001	0,001
ln(CEO tenure)	0,725***	-0,008	0,035	0,743***	-0,007	0,044	0,740***	-0,007	0,043
ln(number of firms in region)	0,972	-0,001	0,026	0,967	-0,001	0,026	0,968	-0,001	0,026
Year fixed effects		Yes			Yes			Yes	
Industry fixed effects		Yes			Yes			Yes	
Number of observations		95 326			93 402			93 402	

Appendix 13 – Controlling for Family CEO in Family Firms

Difference in CEO Turnover Sensitivity to Performance Controlling for Family CEO in Family Firms

*This table provides the results of regression model 3A-C including an additional control variable for family CEO in family firms. The regression models aim to assess the marginal effect of performance sensitivity in family firms on CEO turnover versus non-family. Panel A constitutes regression 3A with family firm dummy variable included. Panel B presents the results of regression 3B including interaction terms on performance. Panel C provides the results of regression 3C incorporating interaction terms on all variables of firm characteristics. The marginal effect for dummy variables is defined as the discrete change from 0 to 1. Definitions of all variables can be found in Chapter 4.2. All NOK values are in 2015 NOKs. Year and industry fixed effects are incorporated in the model. Robust standard errors (SE) were applied to account for potential heteroskedasticity. *, **, and *** imply significance at the 10%, 5%, and 1% levels respectively.*

Dep. var.: CEO turnover	Panel A: Full Sample			Panel B: Full Sample			Panel C: Full Sample		
	Incl. family CEO dummy			Incl. inter. terms on performance and family CEO dummy			Incl. inter. terms on all firm var. and family CEO dummy		
Variables	Odds Ratio	Marginal effects	Robust SE	Odds Ratio	Marginal effects	Robust SE	Odds Ratio	Marginal effects	Robust SE
Constant	0,013***		0,005	0,013***		0,004	0,017***		0,005
Family firm dummy	0,853	-0,004	0,089	0,786**	-0,006	0,095	0,308***	-0,027	0,135
ROA * Family firm dummy				0,820*	-0,005	0,085	0,793**	-0,006	0,083
Profit dummy * Family firm dummy				1,143	-0,004	0,108	1,097	0,002	0,104
ln(revenue) * Family firm dummy							1,063**	0,002	0,030
ln(firm age) * Family firm dummy							1,028	0,001	0,040
Family CEO * Family firm dummy	0,660***	-0,010	0,072	0,657***	-0,010	0,072	0,666***	-0,010	0,073
ROA	0,848***	-0,004	0,039	0,890**	-0,003	0,047	0,898**	-0,003	0,048
Profit dummy	0,885***	-0,003	0,037	0,858***	-0,004	0,042	0,869***	-0,004	0,043
ln(revenue)	1,134***	0,003	0,014	1,134***	0,003	0,014	1,117***	0,003	0,016
ln(firm age)	1,000	0,000	0,028	1,001	0,000	0,028	0,991	-0,000	0,031
CEO age	1,017***	0,000	0,002	1,017***	0,000	0,002	1,018***	0,000	0,002
CEO ownership	0,978***	-0,001	0,001	0,978***	-0,001	0,001	0,978***	-0,001	0,001
ln(CEO tenure)	0,772***	-0,007	0,031	0,770***	-0,007	0,031	0,772***	0,007	0,031
ln(number of firms in region)	0,957*	-0,001	0,023	0,956*	-0,001	0,022	0,956*	-0,001	0,023
Year fixed effects		Yes			Yes			Yes	
Industry fixed effects		Yes			Yes			Yes	
Number of observations		114 934			114 813			114 813	

Appendix 14 – Probit Model

Probit Model for CEO Turnover to Performance Sensitivity

*This table provides the results of regression model 2A-B assessing the difference in CEO turnover between non-family firms and family firms. Panel A and B constitute regression 2A, while panel C constitutes regression 2B results including family CEO dummy variable for family firms. The marginal effect for dummy variables is defined as the discrete change from 0 to 1. Definitions of all variables can be found in Chapter 4.2. All NOK values are in 2015 NOKs. Year and industry fixed effects are incorporated in the model. Robust standard errors (SE) were applied to account for potential heteroskedasticity. *, **, and *** imply significance at the 10%, 5%, and 1% levels respectively.*

Dep. var.: CEO turnover	Panel A: Non-Family Firms			Panel B: Family Firms			Panel C: Family Firms		
				Excl. family CEO dummy			Incl. family CEO dummy		
Variables	Coefficients	Marginal effects	Robust SE	Coefficients	Marginal effects	Robust SE	Coefficients	Marginal effects	Robust SE
Constant	-2,004***		0,159	-2,890***		0,241	-2,731***		0,243
ROA	-0,045*	-0,003	0,025	-0,153***	-0,007	0,040	-0,149***	-0,007	0,040
Profit dummy	-0,064***	-0,005	0,022	-0,022	-0,001	0,338	-0,022	-0,001	0,034
Family CEO dummy							-0,236***	-0,014	0,050
ln(revenue)	0,048***	0,003	0,064	0,071***	0,003	0,105	0,069***	0,003	0,011
ln(firm age)	0,003	0,000	0,016	-0,004	0,000	0,021	-0,002	0,000	-0,002
CEO age	0,007***	0,000	0,001	0,009***	0,000	0,001	0,009***	0,000	0,001
CEO ownership	-0,012***	-0,001	0,001	-0,007***	0,000	0,001	-0,005***	0,000	0,001
ln(CEO tenure)	-0,118***	-0,009	0,022	-0,107***	-0,005	0,031	-0,105***	-0,005	0,308
ln(number of firms in region)	-0,022*	-0,002	0,012	-0,013	-0,001	0,186	-0,012	-0,005	0,187
Year fixed effects		Yes			Yes			Yes	
Industry fixed effects		Yes			Yes			Yes	
Number of observations		72 681			42 227			42 227	

Probit Model for Difference in CEO Turnover Sensitivity to Performance

*This table provides the results of regression model 3A-C assessing the marginal effect of performance sensitivity in family firms on CEO turnover versus non-family. Panel A constitutes regression 3A with family firm dummy variable included. Panel B presents the results of regression 3B including interaction terms on performance. Panel C provides the results of regression 3C incorporating interaction terms on all variables of firm characteristics. The marginal effect for dummy variables is defined as the discrete change from 0 to 1. Definitions of all variables can be found in Chapter 4.2. All NOK values are in 2015 NOKs. Year and industry fixed effects are incorporated in the model. Robust standard errors (SE) were applied to account for potential heteroskedasticity. *, **, and *** imply significance at the 10%, 5%, and 1% levels respectively.*

Dep. var.: CEO turnover	Panel A: Full Sample			Panel B: Full Sample			Panel C: Full Sample		
	Excl. interaction terms			Incl. Inter. terms on performance			Incl. Inter. terms on all firm var.		
Variables	Coefficients	Marginal effects	Robust SE	Coefficients	Marginal effects	Robust SE	Coefficients	Marginal effects	Robust SE
Constant	-2,209***		0,133	-2,207***		0,134	-2,113***		0,140
Family firm dummy	-0,228***	-0,013	0,017	-0,265***	-0,015	0,032	-0,603***	-0,033	0,171
ROA * Family firm dummy				-0,090*	-0,006	0,047	-0,102**	-0,006	0,048
Profit dummy * Family firm dummy				0,058	0,004	0,040	0,042	0,003	0,041
ln(revenue) * Family firm dummy							0,022*	0,001	0,012
ln(firm age) * Family firm dummy							0,009	0,001	0,017
ROA	-0,077***	-0,005	0,022	-0,052**	-0,003	0,025	-0,049*	-0,003	0,025
Profit dummy	-0,052***	-0,003	0,186	-0,067***	-0,004	0,022	-0,062***	-0,004	0,022
ln(revenue)	0,055***	0,003	0,005	0,055***	0,003	0,005	0,049***	0,003	0,006
ln(firm age)	0,002	0,000	0,127	0,002	0,000	0,127	-0,002	0,000	0,014
CEO age	0,007***	0,000	0,001	0,007***	0,000	0,001	0,007***	0,000	0,001
CEO ownership	-0,010***	0,000	0,001	-0,010***	-0,001	0,001	-0,010***	-0,001	0,001
ln(CEO tenure)	-0,117***	-0,007	0,175	-0,118***	-0,007	0,018	-0,117***	-0,007	0,018
ln(number of firms in region)	-0,019*	-0,001	0,010	-0,020*	-0,001	0,010	-0,019*	-0,001	0,010
Year fixed effects		Yes			Yes			Yes	
Industry fixed effects		Yes			Yes			Yes	
Number of observations		114 934			114 813			114 813	

Probit Model for Two-Stage Logit Regression on Industry-Wide Exogenous Shock

*This table provides the results of the two-stage regression model, estimating regression model 5A and 5B, assessing the effect of exogenous shocks on CEO turnover decision. Panel 1A and 1B constitute the results for linear regression 5A on non-family and family firms respectively. Panel 2A and 2B present the results of regression 5B employing the logistic regression on CEO turnover with the predicted values from the first stage regression. All NOK values are in 2015 NOKs. Year fixed effects are incorporated in the model. Robust standard errors (SE) were applied to account for potential heteroskedasticity. *, **, and *** imply significance at the 10%, 5%, and 1% levels respectively.*

	Panel 1: First Stage Regression			
Dep. var.: ROA	Panel 1A: Non-Family Firms		Panel 1B: Family Firms	
Variables	Coefficient	Robust SE	Coefficient	Robust SE
Constant	0,013***	0,001	0,010***	0,035
IROA	0,908***	0,032	0,931***	0,001
Year fixed effects	Yes		Yes	
Industry fixed effects	No		No	
Number of observations	173 992		199 399	

	Panel 2: Second Stage Regression					
Dep. var.: CEO turnover	Panel 2A: Non-Family Firms			Panel 2B: Family Firms		
Variables	Coefficient	Marginal	Robust SE	Coefficient	Marginal	Robust SE
Constant	-1,843		0,022	-1,995***		0,029
Predicted ROA by IROA	-1,594***	-0,091	0,198	-0,266	-0,010	0,282
Predicted Idiosyncratic ROA	-0,068***	-0,004	0,013	-0,061***	-0,002	0,017
Year fixed effects		Yes			Yes	
Industry fixed effects		No			No	
Number of observations		137 333			124 879	

Probit Model for Outside CEO Succession in Family Firms

*This table provides the results of regression model 6 examining the relationship between outside CEO succession and firm performance. The marginal effect for dummy variables is defined as the discrete change from 0 to 1. Definitions of all variables can be found in Chapter 4.2. All NOK values are in 2015 NOKs. Year and industry fixed effects are incorporated in the model. Robust standard errors (SE) were applied to account for potential heteroskedasticity. *, **, and *** imply significance at the 10%, 5%, and 1% levels respectively.*

Dep. var.: Outside CEO Successor	Panel A: Family Firms		
Variables	Odds Ratio	Marginal effects	Robust SE
Constant	-3,109***		0,468
ROA	-0,190***	-0,003	0,062
Profit dummy	-0,074	-0,001	0,055
ln(revenue)	0,073***	0,001	0,021
ln(firm age)	-0,036	-0,001	0,036
CEO age	0,003	0,000	0,002
CEO ownership	-0,007***	-0,000	0,002
ln(CEO tenure)	-0,025	-0,000	0,052
ln(number of firms in region)	-0,044	-0,001	0,032
Year fixed effects		Yes	
Industry fixed effects		No	
Number of observations		37 423	

Appendix 15 – Cox Proportional Hazards Model

Cox Proportional Hazards Model on CEO Turnover to Performance Sensitivity

*This table provides the results of regression model 2A-B assessing the difference in CEO turnover between non-family firms and family firms. Panel A and B constitute regression 2A, while panel C constitutes regression 2B results including family CEO dummy variable for family firms. The marginal effect for dummy variables is defined as the discrete change from 0 to 1. Definitions of all variables can be found in Chapter 4.2. All NOK values are in 2015 NOKs. Year and industry fixed effects are incorporated in the model. Robust standard errors (SE) were applied to account for potential heteroskedasticity. *, **, and *** imply significance at the 10%, 5%, and 1% levels respectively.*

Dep. var.: CEO turnover	Panel A: Non-Family Firms		Panel B: Family Firms		Panel C: Family Firms	
			Excl. family CEO dummy		Incl. family CEO dummy	
Variables	Hazard Ratio	Robust SE	Hazard Ratio	Robust SE	Hazard Ratio	Robust SE
ROA	0,999	0,047	0,809**	0,071	0,816**	0,071
Profit dummy	0,887**	0,042	0,948	0,077	0,950	0,078
Family CEO dummy					0,671***	0,073
ln(revenue)	1,077***	0,012	1,143***	0,026	1,138***	0,026
ln(firm age)	1,469***	0,035	1,475***	0,050	1,485***	0,050
CEO age	1,010***	0,002	1,019***	0,003	1,020***	0,003
CEO ownership	0,976***	0,001	0,986***	0,002	0,988***	0,003
ln(CEO tenure)	0,429***	0,012	0,389***	0,016	0,389***	0,016
ln(number of firms in region)	0,976	0,026	0,984	0,044	0,984	0,044
Number of observations	84 080		48 148		48 148	
Number of failures	2 704		912		912	

Cox Proportional Hazards Model on Difference in CEO Turnover Sensitivity to Performance

*This table provides the results of regression model 3A-C assessing the marginal effect of performance sensitivity in family firms on CEO turnover versus non-family. Panel A constitutes regression 3A with family firm dummy variable included. Panel B presents the results of regression 3B including interaction terms on performance. Panel C provides the results of regression 3C incorporating interaction terms on all variables of firm characteristics. The marginal effect for dummy variables is defined as the discrete change from 0 to 1. Definitions of all variables can be found in Chapter 4.2. All NOK values are in 2015 NOKs. Year and industry fixed effects are incorporated in the model. Robust standard errors (SE) were applied to account for potential heteroskedasticity. *, **, and *** imply significance at the 10%, 5%, and 1% levels respectively.*

Dep. var.: CEO turnover	Panel A: Full Sample		Panel B: Full Sample		Panel C: Full Sample	
	Excl. interaction terms		Incl. inter. terms on performance		Incl. inter. terms on all firm var.	
Variables	Hazard Ratio	Robust SE	Hazard Ratio	Robust SE	Hazard Ratio	Robust SE
Family firm dummy	0,629***	0,025	0,593***	0,043	0,335***	0,115
ROA * Family firm dummy			0,838*	0,083	0,826*	0,083
Profit dummy * Family firm dummy			1,097	0,102	1,075	0,102
ln(revenue) * Family firm dummy					1,045*	0,025
ln(firm age) * Family firm dummy					0,972	0,031
ROA	0,950	0,040	0,990	0,046	0,993	0,046
Profit dummy	0,902**	0,037	0,883***	0,042	0,888**	0,042
ln(revenue)	1,093***	0,011	1,094***	0,011	1,082***	0,012
ln(firm age)	1,468***	0,029	1,471***	0,029	1,480***	0,033
CEO age	1,013***	0,002	1,013***	0,002	1,013***	0,002
CEO ownership	0,978***	0,001	0,979***	0,001	0,979***	0,001
ln(CEO tenure)	0,417***	0,010	0,416***	0,010	0,417***	0,010
ln(number of firms in region)	0,978	0,022	0,977	0,022	0,978	0,022
Number of observations	132 228		132 088		132 088	
Number of failures	3 616		3 598		3 598	

Appendix 16 – Two-Stage Linear Regression Model

Two-Stage Linear Regression on Industry-Wide Exogenous Shock

*This table provides the results of the two-stage regression model employing linear regressions in both stages in estimating regression model 5A and 5B. The aim is to assess the effect of exogenous shocks on CEO turnover decision. Panel 1A and 1B constitute the results for linear regression 5A on non-family and family firms respectively. Panel 2A and 2B present the results of regression 5B employing the linear panel data regression on CEO turnover with the predicted values from the first stage regression. All NOK values are in 2015 NOKs. Year fixed effects are incorporated in the model. Robust standard errors (SE) were applied to account for potential heteroskedasticity. *, **, and *** imply significance at the 10%, 5%, and 1% levels respectively.*

Panel 1: First-Stage Regression

Dep. var.: ROA	Panel 1A: Non-Family Firms		Panel 1B: Family Firms	
Variables	Coefficient	Robust SE	Coefficient	Robust SE
Constant	0,016***	0,001	0,011***	0,001
IROA	0,914***	0,032	0,936***	0,032
Year fixed effects	Yes		Yes	
Industry fixed effects	No		No	
Number of observations	173 992		199 399	

Panel 2: Second-Stage Regression

Dep. var.: CEO turnover	Panel 2A: Non-Family Firms		Panel 2B: Family Firms	
Variables	Coefficient	Robust SE	Coefficient	Robust SE
Constant	0,002***	0,000	0,005***	0,000
Predicted ROA by IROA	-0,103***	0,016	0,000	0,016
Predicted Idiosyncratic ROA	-0,004***	0,001	-0,003***	0,001
Year fixed effects	Yes		Yes	
Industry fixed effects	No		No	
Number of observations	137 333		124 879	