Master Thesis

The Employment Horizon of a CEO and the Relation between Turnover and Innovation

Programme: MSc Finance and Accounting

Author: Remy de Bliek

Student ID: 403568

Supervisor: Dr. J. J.G. Lemmen

Co-reader: Dr. L.A.P. Swinkels

Date final version: 20-5-2020

ABSTRACT

This thesis investigates the effect of the short employment horizon of the CEO on innovation for US firms in the period 2010-2016. The total number of CEO turnovers increased during this century, while the reasons that lead to a CEO change are not always clear. It is also important to investigate the effects in the period after the turnover. It is essential for firms to keep developing their strategies, products and processes. If developments within firms regarding strategies, processes or products stagnate, competition will overtake them. That is why it is not only important to investigate the relation between CEO turnover and innovation, but also the former CEO's reason for departure, which shows the status of a company when experiencing a turnover. Previous literature finds evidence that poor firm performance is positively associated with CEO turnover. There is also evidence that CEO turnover increases innovation. However, the combination of these two studies is not very common in previous empirical literature. This thesis combines the period before and after the turnover. I find a positive relation between the number of consecutive loss years and the likelihood of CEO turnover. I also find evidence that the probability of a CEO turnover in the near future increases innovation. However, I do not find evidence that a new external CEO decreases innovation. New overconfident CEOs decrease innovation, whereas a new CEO that becomes active after a forced departure of the former CEO increases the innovation.

Key words: *Short employment horizon, CEO turnover, consecutive loss years, low profitable firms, high profitable firms, retirement age, tenure, shares owned, innovation, forced turnover, new external CEO, high overconfident CEOs.*

JEL Classification: *G30, G34, O30, O31, O32*

ACKNOWLEDGEMENTS

After hard work, I am pleased to present my thesis for the Master Accounting, Auditing and Finance at the Erasmus University. I would like to express my gratitude to some people that have been supporting me throughout the process of writing this thesis.

Firstly, I would like to thank my supervisor Dr. J.J.G. Lemmen for guiding me throughout the whole process. I would also like to give a major compliment for always responding, even during difficult times due to personal circumstances. Secondly, I would like to thank my parents and friends, who believed in me and supported me during the years at the Erasmus University. Finally, I would like to thank my grandmother, who I promised during her last days to finish this thesis and graduate.

TABLE OF CONTENTS

1. INTRODUCTION

The change in the top management of a firm is one of the most important events that firms experience (Bereskin & Hsu, 2014). Replacing a CEO causes long-term changes in the firm's structures and strategies, especially in investment policies, operating performance and marketing strategies (Miller, Some organizational consequences of CEO succession, 1993; Denis & Denis, 1995). The strategic and social actions of the CEO, including their communication skills to the firm and market, reflect the culture and activities of the firm (Yadav , Prabhu, & Chandy, 2007). The consequences that the change of a CEO may have is not always the obvious or noticeable effect. Off radar effects are often not publicly mentioned. In this thesis, the relation between the short employment horizon of a CEO and innovation is investigated.

According to Matêjka, Merchant and van der Stede (2009), it is possible that a CEO will leave the company voluntarily or forced. It is common to relate the short employment horizon of a CEO to the poor firm performance in the past, where it is likely that a CEO will be replaced after a few years with consecutive losses (Matêjka et al., 2009; Fiordelisi & Ricci, 2014). There are also numerous reasons why it would be more or less likely that a CEO will voluntarily leave the firm, i.e. when the CEO approaches the retirement age, it is generally expected that the CEO will be replaced (Matêjka et al., 2009). The reasons behind the CEO turnover are not always what they seem to be. Poor firm performance could be the consequence of economic circumstances instead of poor performance by top management and excellent firm performance could be related to luck instead of managerial skills (He & Fang, 2016). The first step in this study is to examine the reasons behind the CEO turnover, following the method of Matêjka et al. (2009), who examined the estimation of the likelihood of CEO turnover with relevant social and firm characteristics. The reasons behind the short employment horizon of a CEO give us an explanation about the process after the CEO turnover under an integrated agency-resource view and a perspective including social aspects. According to (Huson, Malatesta, & Parrino, 2004), most of the studies are focused on operating performance and market value after the change of the CEO. It remains unclear what happens with other factors besides performance after the CEO turnover. Today, increasingly advanced technology influences knowledge flows, which has an effect on productivity and, even more so, on innovation (Peri, 2005).

Innovative leadership is important to successfully implement and develop more effective and adaptive organizational systems, which also leads to a better company strategy and therefore a better firm performance (Carmeli, Gelbard, & Gefen, 2010). The key for a successful change in company culture is the encouragement of individual initiatives, which goes together with innovative leadership. It is important that organizations are always moving, which means they need to keep developing their organization. If a firm fails to develop its strategies, products or processes, competition will exceed its performance.

To emphasize the importance of innovation, the rise and fall of Kodak is a good example why organizations must be constantly innovative. Between the periods of 1983 and 1993, Kodak went through seven restructurings (Lucas & Goh, 2009). In 1986, Kodak was the first who introduced the megapixel sensor, which can produce high quality prints. Kodak was the first inventor of digital images and was selling a Photo CD system at the time. With the Photo CD player, the photos can be seen on a television screen, but the production costs were too high. It was never as successful as Kodak had forecasted. Instead of continuing the development and innovation of the digital camera, Kodak also focused on other products. They never dared to fully focus on continuing this development of digital cameras. In 1993, a new CEO arrived, George Fisher. Fisher moved Kodak back towards the focus on photography. Even when it introduced a new digital camera system, Kodak was using film and emphasized print and was still into the photo film and paper business. Consumers were not willing to pay for film and prints anymore. "Kodak considered digital photography as the enemy, an evil juggernaut that would kill the chemical-based film and paper business that fueled Kodak's sales and profits for decades" (Fisher, 1999). Fact was that Kodak lost its top position in the market. Fisher made a beginning to get Kodak back on track, by focusing on innovation and Kodak's strengths.

Knowledge became one of the most important strategic resources for an organization and is a critical factor for the performance of a firm, especially in competitive and dynamic industries (Biscotti, Mafrolla, Del Giudice, & D'Amico, 2018). Edler, Meyer-Krahmer and Reger (2002) find that R&D and upcoming technology are crucial for corporate and business technology. A CEO must make important decisions to keep the company moving forward and keep it up to date. Innovation in new products, processes, strategies and high-tech technology is one of the most important topics in management research these days (Barker & Mueller, 2002).

One of the most competitive markets these days is the High-Tech industry, which includes companies that are the most important sources of innovation (Bart, 1996). High-Tech developments changed the world. The internet, smartphones and computers are all examples of products that made processes like cybersecurity, streaming movies or music and saving your personal property digital or in the cloud possible. Therefore, this thesis also examines the relation between turnover, innovation and high-tech companies.

As said, the first step in this study is to examine the reasons behind the CEO turnover. CEO turnover is a proxy for the short employment horizon of a CEO. The second step is to examine the effect of this turnover on innovative performance. It is important to understand that the short employment horizons affect the long-term investments. Long-term investments affect the economic growth, especially through innovation (Gonzalez-Uribe & Groen-Xu, 2017). CEOs might have little interest in investing in innovation programs, because often these investments have a high-risk factor and are focused on the long-term (Biscotti et al., 2018). On the other hand, the threat of being replaced because of the pressure

from investors or competition affects the CEOs' policy to invest and innovate (Aghion, van Reenen, & Zingales, 2013). This can be the first step in the appearance of an agency problem, which is the misalignment of interests between the principal and the agent, causing a conflict of interest (Jensen M. C., 1986). According to Jensen and Meckling (1976), an agency problem will appear because there is disengagement of ownership and control. Therefore, this study focuses on the following research question:

"Does the short employment horizon of a CEO affect innovation performance?"

Former studies have different outcomes according to this research topic. If the CEO has a longer time horizon, which means that the CEO is not replaced on short notice, there is less innovation (Jensen & Meckling, Theory of the Firm: Managerial Behavior, Agency Costs and Ownership Structure, 1976; Roe, 2013). Stein (1988) examined that the quality of innovation is improved because of the longer time horizon, which means the CEO is not replaced on short notice either. This study provides an insight view of the reason behind a CEO turnover and the effect of the short employment horizon of a CEO on innovation performance.

This study contributes to the literature in several ways. First, the combination of the examination between the periods before and after a CEO turnover related to innovation has not been done in previous literature. Another contribution is the sample period. This sample is based on US firms between 2010-2016. Therefore, it is a representative study regarding the more recent sample period.

The findings are separated into two parts. First, I measure the reasons why a CEO will leave the company. I find evidence that consecutive loss years lead to more CEO turnovers, whereas high profitable firms experience less turnovers. Second, I calculate the predicted probability of a CEO turnover in 2015 or 2016 based on the outcome of the first logistic regression. In the second part I find evidence that CEO turnover is positively associated with innovation. I also find that forced CEO turnovers lead to more innovation. However, I find no evidence regarding the expectation that new external CEOs are negatively associated with innovation. In this study, new overconfident CEOs have negative influence on innovation. This outcome is not in line with previous studies, but the outcome changes in a positive relation after including industry fixed effects.

The structure of this thesis is as follows. Chapter 2 discusses the literature review related to the most important concepts, CEO turnover, innovation and the agency theory related to these concepts. Chapter 2 also discusses the relation between the relevant concepts. Chapter 3 includes the hypotheses development, based on the literature review of chapter 2. Chapter 4 presents the data and methodology, where results will be discussed and analyzed in chapter 5. Finally, chapter 6 presents a discussion on the outcome resulting from this study.

2. LITERATURE REVIEW

2.1 Introduction concepts

2.1.1 CEO turnover

The resource dependence theory tells us that a different leader might contribute to the change an organization makes in its company culture or way of thinking (Biscotti et al., 2018). The long-term trends of CEO turnover decisions are different over time (Huson, Parrino, & Starks, 2001). Forced turnover and new external CEOs both increased between 1971 and 1994, meaning that the nature of CEO turnover has changed (Huson et al., 2001). Kaplan and Minton (2006) find that in the more recent period since 1998, total turnover increased to 16.5%, which is more than the 10% in the 70s and the 11% in the 80s.

There are several reasons to replace a CEO. Former studies examined the relation between 'board independence and CEO pay' and turnover. When a company needs a new CEO, there are possibilities to an outsider or an insider. The outside candidate will not have previous working experience in the company, whereas an inside candidate will have previous work experience in the company. Laux (2008) found that firms will fire their CEOs more often when there are more independent board members. In former studies, it is common that a management with a small number of outsiders is used as a proxy for board independence (Laux, 2008). When a board has more outsiders than insiders, it is more likely the CEO will get fired after years of consecutive losses and this relation is even more significant because of the higher compensation the CEO receives (Matêjka et al., 2009; Laux, 2008; Core, Holthausen and Larcker, 1999; Lambert, Larcker and Weigelt, 1993; Weisbach, 1988). Independent boards seem indeed more critical, because the company board is accountable to the shareholders.

It becomes a horizon problem when managers are in the last few years of their contract (Marinovic & Varas, 2019). Managers will intensify performance manipulation in their final years at the company and their decisions will be based on short-term performance to optimize their payments (Marinovic & Varas, 2019). Dechow and Sloan (1991) find that CEOs are not willing to invest in R&D when they are at the end of their employment period. This means that CEOs with a short employment horizon will act on their own interest. Cutting R&D investments is in their own interest, because it is profitable for the firm and therefore profitable for the CEO (Dechow & Sloan, 1991). An almost retired executive officer is also more likely to act in his or her own interest to maximize his or her own benefits, which is the same for executive officers with company stock (Şabac, 2008; Matêjka et al., 2009). Matêjka et al. (2009) also find that it is less likely that CEOs who have been chairman for at least ten years are leaving the company. These examples of CEO turnover, related to firm performance and social reasons, can cause high agency costs.

2.1.2 Agency theory and issues

An agency relationship arises between two parties, the agent and the principal, where the agent acts as a representative for the principal (Ross, 1973). If the agent and the principal both are utility maximizers, the agent will not always act in favor of the principals (Jensen & Meckling, 1976). The agency theory can be found in all contractual arrangements on different scales, which means that for example an employee has an agency relationship with the employer, or the management with the shareholders (Ross, 1973). According to Jensen and Meckling (1976), an agency problem will appear because there is a difference between the interest of people that own the company and people that control the company.

The agency theory discusses that managerial actions will differ from the actions which will maximize shareholder returns, meaning there will be an agency problem when the management can limit the adaptive power if environmental changes occur (Berle & Means, 1933; Wry, Adam, & Aldirch, 2013). Wry et al. (2013) conclude that organizations could not survive if they are not able to manage the demands of the environment. To reduce the agency problems, the residual loss must be reduced, which is the consequence of the agency problem that occurs when the preferred outcomes of the principal and the agent are not in line with each other (Jensen & Meckling, 1976; Eisenhardt, 1989). Letting the agents act in line with the principals is the main goal of the agency theory, given that there must be an optimal contract between people, organizations and information. Jensen and Meckling (1976) believed that people are self-interested with risk avoidance behavior. They also noticed that the stakeholders of organizations have different goals and that there is a possibility of asymmetric information. Controlling the agent and incurring costs that give the principals insurance that the agent will act in line with their interest will limit the actions of the agent that could negatively influence the principal (Jensen & Meckling, 1976).

A solution to solve this problem is the replacement of high executives. A new CEO is less attached to the status quo of the company and therefore it is more likely that a new CEO is willing to make changes in the company's strategy (Weng & Lin, 2014; Pfeffer & Salancik, 2003). If the new CEO is able to make changes in the status quo, it is concluded that new investment opportunities are being made (Biscotti et al., 2018).

It is likely that a new leader will bring his or her own management team, or at least a part of it (Farrel & Whidbee, 2002). The composition, existence and effectiveness of the various board committees can impact the overall performance and effectiveness of the board. The agency problem occurs between the principal and the agent if both have different goals and if there is asymmetric information between the involved parties (Shleifer & Vishny, 1997). There are CEOs who are able to control the selection process of the board, especially when the CEO is involved in the nomination process (Farrel & Whidbee, 2002). Klein's (1998) examinations shows that executive officers have significant control over the nominating committee and therefore have the power to assign board members who are in their favor. The downside

is that shareholders do not have the certainty that the new CEO will also act in their favor and at the same time bring better performance to the firm (Inderst & Mueller, 2010). To earn the trust of the shareholders, the new CEO must act with strategic behavior in their favor to minimize the probability to get fired (Biscotti et al., 2018). According to Donaldson and Davis (1991) the CEO needs motivation and incentives to act in favor of the shareholders so that the interests are maximized. This is in line with the solution to reduce agency loss, however in practice it is impossible for the agent to always act in a way that is in line with the expectations of the principal (Jensen & Meckling, 1976).

2.1.3 Innovation

According to several studies, Schumpeter (1984) was the first person who started investigating innovation (Strecker, 2009). The implementation of new products, new processes, new goods or new production methods are examples of innovation, which are all replacements of older versions (Hauschildt J. , 2004). Johannessen et al. (2001) described innovation as the introduction of new products, new methods, new sources, new strategies and organizations and new markets. Innovation is defined in multiple ways in history and the definitions changed over time. Barnett (1953, p. 7) defined innovation as "any thought, behavior or thing that is new because it is qualitatively different from existing forms". According to Schmookler (1966) an innovative organization is defined as an organization that produces a good or service or a new process that makes a technical change. Schmookler (1966) also stated that the first company that makes a technical change is called an innovator, and when an innovator innovates, it is called innovation. This definition suggests that innovation is about the technical evolution. But it does not always matter whether an idea, product or process is new, because it is an innovation when a device, policy, process, service, system or product is new to the particular individual or adopting organization (Rogers, 1983; Damanpour, 1991). A difference is being made between radical innovation and incremental innovation. Radical innovation means that the status quo will be broken, meaning that the implemented innovation is new. An incremental innovation is not a whole new product or process, but only a new part of the product or process (Ettlie, Bridges, & O'Keefe, 1984). Zaltman, Duncan and Holbek (1973) defined innovation as "any idea, practice or material artifact perceived to be new by the relevant unit of adaptation". Rogers (1983), Zaltman et al. (1973) and Damanpour (1991) made a separation between the actual new products or processes, when it is completely new, and when it is only new for the relevant unit of adaptation.

Innovation is a process that feeds the needs (Tushman & Moore, 1982). Producing that need or a product that feeds this need is the precise definition of innovation, according to Moore and Trushman (1982). Rickards (1985) agrees and finds that innovation is a process of matching the problems and solving these problems. With these definitions, innovation would be a broad understanding, which is hard to determine. How to solve these problems is already a step towards a better determined definition. If the solution of these problems is a new product, process or strategy, it's called innovation (Rickards, 1985).

Dean and Goldhar (1980, p. 284) put those different perspectives together and defined innovation as: "from idea generation to problem-solving to commercialization, is a sequence of organizational and individual behavior patterns which are connected by formal resource allocation decision parts". Dosi (1988) agrees with Dean and Goldhar (1980) and note that it is a search for and discovery of new products, imitation, experimentation and development.

In this thesis, I follow the definition of Hauschildt (2004, p. 7):

"Innovations are qualitatively new products or processes,

which distinguish themselves significantly from previous ones".

The outcomes of innovations must add value to a company (Strecker, 2009). In this thesis, the research question is focused on innovative performance, a proxy for innovation.

2.2 Measurement of concepts

2.2.1 CEO Turnover

As mentioned in the introduction, previous studies examined the reasons behind the CEO change. Kaplan and Minton (2006) considered two types of turnover, internal turnover and external turnover. Standard turnover is one of the most common measurements of turnover in studies regarding a CEO change, while external turnover is usually caused by a negative reason, i.e. consecutive loss years, bankruptcy or mergers and acquisitions (Kaplan & Minton, 2006). In general, negative reasons are examined in previous studies such as Matêjka et al (2009), who used consecutive loss years as a proxy for the likelihood of CEO turnover. They selected firms with five consecutive loss years with the general expectation that after repeated losses the CEO is leaving the company. Standard CEO turnover models in the literature include the assumption that the board has the relevant information to research the relationship between the CEO and firm performance.

Most studies include CEO characteristics as control variables into their research. Characteristics such as age, an internal or external CEO, tenure, gender and stock possession are widely used as control variables for CEO turnover. In general, CEO turnover is associated with firm performance characteristics such as consecutive loss years, total number of loss years, negative net income or changes in returns.

2.2.2 Innovation

The measurement of innovation is different in previous studies. There are different ways to measure innovation, but the most common way is the intensity of Research and Development (R&D). To measure innovation through the intensity of R&D, the R&D expenditures are divided by total assets. Table 1 gives an overview of previous studies which used R&D intensity or spending as the measurement to measure innovation for bigger firms (Bester & Petrakis, 2003). The R&D expenditures and therefore

intensity is less accurate regarding innovation for small, medium-sized and startup firms (Adams, Bessant, & Phelps, 2006).

Previous studies used R&D expenses in combination with CEO turnover to capture the effect of CEO turnover on innovation (Bereskin & Hsu, 2014). Murhpy and Zimmerman (1993) and Dechow and Sloan (1991) used R&D expenses as proxy for innovativeness and concluded that patent data is more accurate than R&D expenses to measure innovation. Kraiczy, Hack and Kellermans (2015) used CEO innovation as an antecedent of R&D intensity, focused on small and medium-sized firms. It is difficult to collect data for small and medium-sized firms which are not always publicly traded. This information asymmetry is the reason that R&D intensity causes discussions regarding innovation (Jalles, 2010).

Another method is the measurement of patents. Patents give you the ownership rights of the use of an idea or product, which also gives a legal monopoly (Fawcett & Torremans, 2011). This method is divided into two general approaches. The most common approach is the patent counts. Patent counts focusses on the output of innovation, which makes it a direct relation with innovation (Acs, Anselin, & Varga, 2002). Patent counts as measurement of innovation comes along with criticism. Bester and Petrakis (2003) say that patents are not protected when there are imitation risks. Hellwig and Irmen (2000) say that it is too difficult to acquire a patent and if patents are acquired it seems that firms grow faster than the number of patents over time.

The third way to measure innovation is also related to patents. Patent citations are used when the idea or product is used by others, which is referred to the patent. Because of the citations the patents are generally accepted as a measure of innovation (Trajtenberg, 1990). Leading is the way of Wright (1983), who was focused on identical innovations that researchers tried to make. Bereskin and Hsu (2014) used patent data to measure the output level and the efficiency of intangible investments, capturing the relation between the CEOs and the investments in performance and strategies. They give three reasons why patent data is the most effective way of measuring innovation. First, patent data include almost all important innovations. Firms protect their inventions and are thus more active to collect patents for their innovative products and strategies. Second, patents can be traded, which can make a lot of money at the market, which can give organizations a money injection. Third, Deng, Lev and Narin (1999) and -, Gu (2005) have shown that firm performance and market value is explained while measuring innovation with patent data.

Even when the opinions about the best measurement of innovation differ in previous studies, it is a fact that patent data is not easy to collect. Most of the studies used the NBER patent data which is only available until 2006. Most of the previous literature is therefore investigated for the period before the year 2006 if patent data is the measurement of innovation. Another possibility is the google patent database. This is not ideal, because patent data can only be collected by hand and this takes a lot of time.

2.3 Relations between concepts

2.3.1 CEO turnover and firm performance

There are several reasons to replace an executive. Previous studies are mainly focused on operating performance and market value after the replacement (Huson et al., 2004). The short employment horizon of a Chief Executive Officer, the CEO turnover, can be related to a voluntary or forced departure (Matêjka et al., 2009). Denis and Denis (1995) conclude that forced CEO dismissals are generally related to poor firm performance.

After the replace of a top executive, the decline in operating performance is followed by large improvements in performance. In addition to voluntary departures, forced resignations are not common and are in general related to external factors. External factors are block holder pressure, takeover attempts and media attention (Denis & Denis, 1995).

Firms are much more in the spotlight, because media attention is more intensive than it was prior to the turn of the century. Media exerts pressure on firms (Bednar, 2012). Bednar (2012) documents that negative media attention of a CEO increases the likelihood of CEO turnover or pay reduction and positive media attention increases the job security and compensation of a CEO. Also, there is much more attention in the financial press about the impact of a CEO replacement on the succession of the CEO composition determined by the management team (Farrel & Whidbee, 2002). Overall, today there is more pressure from external parties which may bring more attention to the executive officer combined with firm performance (He & Fang, 2016). The most attention is related to CEO pay which increased from 1970 and substantially after 1995 (Jensen & Murphy, 2004; Bebchuk, Fried, & Walker, 2002). If the board fails to perform, the board of directors is criticized for the increase in CEO compensation and their monitoring policy (Bebchuk & Grinstein, 2005).

Although the former mentioned independent boards with outside board members are capable of reducing the agency costs, previous studies found a relation between internal turnover and firm performance (Murphy, 1999). Kaplan and Minton (2006) examined the relation between internal turnover and firm performance. They found that internal turnover is related to three components of firm performance, namely that the relation between turnover and performance is affected by the industry, that the industry is affected by the stock market and that the turnover is influenced by the overall stock market (Kaplan & Minton, 2006). According to Matêjka et al. (2009), turnover increases after several years of consecutive losses. Firms with low profitability and loss-making firms are more likely to experience turnover than highly profitable firms. They also found that the more years of consecutive losses increases the more chance of a CEO turnover. In higher profitable firms, it is more likely that a CEO who is approaching the retirement age will leave the company (Matêjka et al., 2009). Not only consecutive losses, but also the firm's poor stock price performance is related to the likelihood of CEO turnover (Coughlan & Schmidt, 1985; Warner, Watts, & Wruck, 1988). Even when factors of poor firm

performance are beyond the control of the CEO, he or she still is replaced (Jenter & Kanaan, 2015). This is also examined by He and Fang (2016) and Kaplan and Minton (2006), who claim that poor firm performance can be related to bad economic conditions and poor industry performance rather than bad performance of the top management.

Poor firm performance is classified under forced turnover, which is the same for conflicts between the CEO and the board, financial wrongdoing, lawsuits and pressure from the investors or other stakeholders (Denis & Denis, 1995). Normal retirement, when approaching the retirement age, sickness and career ambition is classified as voluntary turnovers. Prior studies find that companies with abnormal returns experience more forced turnovers than voluntary turnovers and these companies have greater changes in their strategy and structure than voluntary turnovers (Denis and Denis, 1995; Borokhovich et al., 1996; Huson et al, 2004).

2.3.2 Innovation and performance

In this thesis, the relation between CEO turnover and innovation performance will be studied. If CEO turnover is influenced through firm performance and firm performance is influenced through innovation, the vicious circle is completed. Therefore, it is important to understand that innovation can also have an impact on firm performance, while firm performance can also indirectly influence innovation through CEO turnover.

The success of the implemented innovation strategies mostly depends on the financial performance of the firm (Hauschildt J. , 1991; Griffin & Page, 1996). Financial performance is the general accepted measure of innovative performance. A positive financial performance is the ultimate goal of new strategies, products or processes. Therefore, it is a general expectation that innovations have impact on firm performance, while people actually talk about financial performance. This is the missing relation between innovation and firm performance (Griffin & Page, 1996). It is important to keep competitive advantage and add firm value, especially in a fast-changing environment (Bilton & Cummings, 2010). Innovation performance brings new intangible assets into the organization and can add firm value, keeping competitive advantage (Wang & Wang, 2012). There are studies that did research on the relation between innovation and firm performance within small firms. Geroski and Machin (1993) claimed that a fast-growing small firm is associated with innovation. A small firm that innovates creates a rapid growth on the market, which is in line with previous studies (Moore, 1995; Roper, 1997).

However, there is a downside of being more innovative. Innovation is often associated with highly competitive industries, which means that companies need to develop products or processes that are cheaper and more efficient. Companies create new products at low prices and increase competition in the market (Hitt et al., 1997). The risk of investing in innovation is higher due to these extremely competitive markets. Previous literature highlighted that radical innovation implementation can cause serious problems related to the value of the firm. First moving firms that show their innovation

knowledge run the risk of their product being counterfeited in a better way (Abrahamson, 1991). Due to competition, the probability that a unique and therefore new product brings ideas to the competitors to make a better version of the product increases. The competitive advantages build up shortly after bringing the new idea or product at the market and this is resulting in temporary high profitability (Barney, 1991). The high profitable situation shortly after investments in innovations can also cause higher volatility due to the increase in firm-specific risks. Firms with unique products will also have an increase in difficulty to make adaptions and changes to their new or improved product (Wang & Chen, 2010). This means that, as mentioned before, if competitors can make a better version of the product and the firm is not able to make changes to their own product, innovations may fail due to competitors with better versions of the product. These risks are also higher for firms that are not able to find alternative ways to implement their innovation. This dynamism leads to a reduced value of firm innovations or, when innovations fail, to a reduced value of the firm (Wang & Chen, 2010).

The studies from table 1 investigated the relation between innovation and firm performance. This table includes the authors, the relationship studied and the key findings according to the hypothesis given. I selected several studies including the relationship between innovation and firm performance. Firm performance can be separated in different sub-categories, like financial performance and operational performance. These sub-categories can be divided into different measures, i.e. profitability, (sales) revenue and firm growth. In general, it can be concluded that innovation is positively associated with firm performance, especially on the long-term. It appears that firms will learn from innovation developments and performance will therefore be positive in the future (Hatzikian, 2015).

2.3.3 CEO turnover and Innovation

According to Bereskin and Hsu (2014) innovation performance contains the output level and efficiency of intangible investments, future profits and competitiveness in a knowledge-based economy. Conservative managers are not comfortable with changes in their strategy and vision due to the risks involved (Aghion et al., 2013). Instead, CEOs are more interested in the actual number at the end of the period and cutting expenses or investments are one of the most common actions a CEO takes to end up with better earnings (Bereskin & Hsu, 2014). It means that CEOs will manipulate their end of the year earnings by cutting the expenses or investments. It is obvious that they reduce the R&D expenses and are not willing to take risky investments. R&D expenses or investments are not earned back yet, which makes it logical to reduce them instead of other expenses. These actions appear even more when the CEOs have short-term contracts which is negatively associated with investing in innovation (Manso, 2011).

Table 1. *An overview of previous studies including the relationship between innovation and firm performance*

Author(s) (publication year)	Relation Studied		Key Finding
	Dependent variable ***(Measurement)***	**Independent variable** ***(Measurement)***	
Geroski and Machin (1993); Geroski (1991)	Profitability and Growth *(ROA, log of sales)*	Innovation *(Product and process innovation econometric model)*	+ Innovation is positively associated with profitability, sales growth and growth in market value
Moore (1995); Roper (1997)	Profitabilty and Growth *(Turnover and employee growth)*	(Product) Innovation *(Productivity growth, R&D capability)*	+ Innovation is positively associated with the rapid growth of small firms.
Blundell, Griffith and van Reenen (1999)	Firm Performance *(Value function of market share, fixed capital and knowledge capital)*	Technological Innovations *(Value function of market share, fixed capital and knowledge capital)*	+ Innovation has a positive effect on the market value of stocks
Sorescu, Chandy and Prabhu (2003)	Firm Performance *(Sales, assets, profits)*	New products (Pharmaceuticals) *(Radical innovations, Market breakthroughs, technology breakthroughs)*	+ Radical innovations are more valuable than technological developments inside an organization
Thornhill (2006)	Firm Performance *(Revenue growth)*	Innovation *(1 = new product in 1999, 0 = otherwise)*	+ Innovation is positively associated with firm performance (Measured by Revenue Growth). - not moderated by type of industry
Wang and Wang (2012)	Financial performance, operational performance *(Questionnaire average return on investment, average profit, profit growth and average return on sales)*	Innovation speed, innovation quality *(Questionnaire explicit knowledge, quick idea generation, new product launching and development, new processes, new problem solving methods)*	+ Innovation Speed is positively associated with firm operational and financial performance. Innovation Quality is associated with financial performance - has no effect on operation performance
Hatzikian (2015)	Firm Performance *(Labor productivity = annual sales per number of employees)*	Innovation *(Innovation expenditure per annual sales, percentage R&D personnel)*	- Firms experience negative performance on the moment of investments in innovation + Firms learn from innovation development and performance becomes positive in the long-term

+' indicates a positive relationship, '-' indicates a negative relationship. Profitabilty, firm growth and revenue are firm performance measures (general term). Firm performance can also be separated in financial performance and operational performance (Wang and Wang, 2012)

When a CEO experiences a forced turnover, the new CEO is often not prepared and is holding back risky investments (Weng & Lin, 2014). The forced CEO turnover is also the cause of unexpected reactions that can cause damage to the trust to invest in long-term innovation plans, which is not the case with normal or voluntary dismissals (Denis & Denis, 1995). Clayton, Hartzell and Rosenberg (2005) undermined this conclusion and find that a forced CEO turnover is positively associated with the stock price volatility.

Datta and Guthrie (1994) find that when new CEOs are outsiders, they are unfamiliar with the company culture, products and capabilities and are therefore underperforming in new investments. In contrast of the outcome of Datta and Guthrie (1994), Huson et al. (2004) find that an outsider as a new CEO is positively associated with firm performance. They conclude that firm performance improves after the change to an outsider (Huson et al., 2004). Firing CEOs who are entrenched and are not willing to take risky investments positively affect operating returns (Fisman, Khurana, Rhodes-Kropf, & Yim, 2014). Sunder, Sunder and Zhang (2017) motivate this conclusion by finding that sensation seeking personalities identifies CEOs who have the drive for innovation success. They tested the sensation seeking personalities with airplane pilots and conclude that these personalities are a proxy for CEOs that

are risk taking in the companies they lead. Younger CEOs are more willing to take risks than older CEOs and are therefore more sensation seeking personalities (Herrmann & Datta, 2006). Younger CEOs who are more willing to take risks are important for the creation and implementation of innovation (Tan, 2001). Also, younger CEOs are more positively associated with the use of newest technology and have better cognitive abilities (Burke and Light, 1981; Huson et al., 2014). These aspects have a positive contribution to the capability of creating and implementing innovation and can rely on those cognitive abilities while experiencing inexperience (Björk, 2012). It became clear that older CEOs are making more incremental changes than younger CEOs (Child, 1974).

Younger CEOs often have less experience. CEOs with shorter tenure have less experience than CEOs with long tenure, logically. Thomas, Litschert and Ramaswamy (1991) find that CEOs with longer tenure stick to the current business strategies and are less willing to take risks. As mentioned above, younger CEOs happened to be looking for more sensation than older CEOs which means that CEOs with less experience are more risk seeking than older CEOs (Finkelstein & Hambrick, 1990). As mentioned before, younger CEOs have more affinity with upcoming technologies and high-tech developments than older CEOs who are less willing to develop new skills (Weng & Lin, 2014). Older CEOs are willing to take incremental actions rather than radical actions. They expand the status quo rather than changing it (McClelland et al., 2010; Weng and Lin, 2014). Assuming logically that the older CEO has more experience and more tenure which will lead to less innovation. On the other hand, CEO tenure may initially boost firm performance (Miller & Shamsie, 2001).

Miller (1991) also finds that external CEOs know the environmental conditions and will therefore boost the firm performance initially. Although it will be a positive result in the first periods of the new external CEO, often the new external CEO becomes committed to the earlier implemented strategy. Here, tenure declines firm performance in the long-term. If the firm performance still increases, the curve is less steep than when the CEO implement new plans of innovation (Miller, 1991; Hambrick & Fukutomi, 1991). So, external CEOs are more innovative at the beginning and less innovative in the long-term pared with more tenure. Insiders will be less innovative and stick to the status quo of the company, especially when it concerns a long-tenured CEO while short-tenured CEOs are willing to introduce innovation (Wu et al., 2005).

Matêjka et al. (2009) find that CEOs with a greater percentage of shares owned are more likely to stay in the firm. It makes sense that a CEO with many shares would like to maintain authority over his own company. Also, why would the CEO leave the company if he or she is getting profit out of dividends? Chief executive officers with a high percentage of shares owned, will also be conservative in their risk-taking policy. They will not take the risk to enter new strategies or make new products, which could have negative effects on their payment or reputation. Aghion et al. (2013) did research on institutional ownership, which leads to more innovative leadership with new strategies or products. In table 2 there

are more studies including the relationship between age, education, tenure, stock ownership, general CEO turnover and innovation. As mentioned, there are several studies focused on R&D spending, while other studies are focused on using patent data to measure innovation output. Table 2 gives an overview of previous studies which includes the relationship between the CEO and R&D spending. Note that previous studies have different proxies for innovation as the dependent variable. A few studies use innovation as an overall dependent variable, whereas others use R&D investments or change as a proxy for innovation.

Table 2. *An overview of previous studies including the relationship between the CEO and R&D spending*

Author	**Relation Studied**		**Innovation measurement**	**Key Finding**
	Independent variable	**Dependent variable**		
Elder (1975)	Age	opinion change and decision making	-	+ Younger CEOs change their opinion more than older CEOs (influencing decision making)
Hayes and Abernathy (1980)	Education and work experience	Technological innovation	R&D expenditures	+ A higher education level and more work experience lead to more R&D investments
Chaganti and Sambharya (1987)	Background CEO	R&D investments	R&D expenditures	+ CEOs with financial and R&D backgrounds invest more in Research and Development
Butler and Newman (1989)	CEO Employment Horizon	R&D investments	R&D expenditures	- The employment horizon of a CEO is not associated with more R&D investments
Porter (1990)	Technological and scientific backgrounds	R&D investments	R&D expenditures	+ CEOs with technological and scientific backgrounds invest more in R&D
Baysinger et al. (1991)	Institutional ownership	Innovation	R&D intensity	+ Greater percentage of ownership leads to more R&D intensity
Murhpy and Zimmerman (1993)	CEO Turnover	R&D investments	R&D expenditures	- CEO change leads to less R&D investments
Daellenbach et al. (1999)	CEO characteristics	R&D investments	R&D Intensity	+ Technological backgrounds are positively associated with R&D investments. - Other characteristics are not associated with R&D investments
Tan (2001)	Risk taking individuals	Innovation	Strategic Orientation questionnaire	+ Risk taking individuals are positively associated with more innovative actions
Yadav et al. (2007)	Age	Energy, stress and implementation of change	Speed of detection, speed of development, breadth of deployment	- An increase (decrease) in age decreases (increases) the energy level, - decreases (increases) stress resistancy and - decreases (increases) innovative change
Quigley and Hambrick (2012)	CEO tenure	Strategic Changes	Advertising intensity, R&D Intensity, Selling, general and administrative intensity	- Long-tenured CEO follow the status quo and less change occur. + a new appointed CEO increases strategic changes

Note: '+' indicates a positive relationship, '-' indicates a negative relationship. Most of these studies used R&D investments as proxy for innovation.

3. HYPOTHESES DEVELOPMENT

In this chapter, the research question and the hypotheses are discussed and developed. It is based on prior literature and theoretical background, mentioned in the literature review.

3.1 Research Question

As mentioned in the introduction, this thesis investigates what the effects of the short employment horizon – CEO Turnover – are on the innovation performance in firms. The research question is stated as follows:

"Does the short employment horizon of a CEO affect innovation performance?"

To investigate the possible relationship between the CEO turnover and the innovation performance in firms, the following hypotheses are developed. The control variables are also mentioned. This thesis is structured following different steps. First, I will investigate the reasons behind the CEO turnover. Second, I will use these reasons of CEO turnover as a proxy for the short employment horizon of a CEO and investigate the relation between this turnover and the innovation performance of firms. The hypotheses are also constructive towards the end conclusion.

3.2 Formulation of H1: Firm performance and CEO turnover

The effect of the firm performance on the likelihood of a CEO turnover is explained.

3.2.1 Firm performance

Pukthuanthong, Ullah, Walker and Zhang (2018) linked CEO turnover to firm performance. They find that CEO turnovers caused by conflicts between board members and CEOs about the strategy of the company are created by the effect of poor firm- and stock performance. They also noticed that firm performance increases after the change of a CEO (Pukthuanthong et al., 2018). Table 3 provides an overview of the variables that might affect CEO turnover, following the approach of Matêjka et al. (2009). The general expectation is that consecutive loss years increase the likelihood of CEO turnover. This means a shorter employment horizon, which is not the case for companies with high profits. Matêjka et al. (2009) find that low profit firms experience more CEO turnover and a CEO who is approaching the retirement age is more likely to leave the firm. The longer the tenure, a higher degree and a greater percentage of shares owned decreases the likelihood of CEO change. When a firm experiences high profits, it is less likely that the CEO will leave the firm. In Matêjka et al. (2009), the high profit firms are used as control group.

Based on the effects described above and the written literature, the following hypothesis is formulated:

H1: Poor firm performance increases the likelihood of CEO turnover.

Table 3. *An overview of the effect of firm performance and CEO characteristics*

Variable	Literature	Expected Effect
Firm Performance		
Losses 1 - 6	With the term Losses 1 to 5, this study follows the approach of Matêjka et al. (2009). They find that the probability of CEO departure is higher in loss-making firms, especially for firms with five consecutive loss years (Joos and Plesko, 2005; Matêjka et al., 2009)	+
LowProfit	Firm performance is one of the key aspects in the study of Matêjka et al. (2009). They find that low profit firms are more likely to experience a CEO turnover (Huson et al., 2001).	+
HighProfit	High profit firms are used as control group. It is less likely that a highly profitable organization will have to replace the CEO (Huson et al., 2001).	-
CEO Characteristics		
Age	When the CEO approaches the retirement age, it is more likely that the CEO will leave the company. The number of departures around the age of 65 is higher than at other ages (Weisbach, 1995). Approaching retirement age increases the likelihood of CEO turnover.	+
Tenure	The relationship between firm performance and forced turnover is negative throughout an inside CEO's tenure (Allgood and Farrel, 2000).	-
Gender	Previous studies find that women are more socially oriented, which means that they care about other people more than men (Boulouta, 2013). If they connect with employees better than a male CEO, it is less likely that a female CEO is getting fired.	-
SharesOwned	CEOs who own a greater percentage of shares are more likely to stay in the firm than CEOs who do not own a greater percentage of shares.	-

3.3 Formulation of H2: CEO turnover on innovation

In this section, I will investigate the relationship between the new CEO and innovation performance.

3.3.1 The short employment horizon

Murphy and Zimmerman (1993) note that CEO replacement is a function of firm performance and CEO age. This is supported by Strecker (2009) who claims that taking innovative actions is equal to investments under uncertainty. Being innovative can contribute to a firm's position in the market and increases the competitive advantage (Kleinschmidt & Cooper, 1991). In this thesis, I follow the approach of Hirschleifer et al. (2012) who focus on the level of R&D intensity. They used the R&D intensity as a proxy for innovation. R&D expenditures are scaled by total assets. As mentioned before, all studies regarding patent counts or cites are investigating a period before the year 2006. Despite those patent counts are difficult to collect immediately after 2006 and patents granted decrease in the second half of the 20th century, the CEO can also manipulate the patent counts by reducing or increasing the R&D expenditures (Lerner & Wulf, 2007). A CEO can also ask for patents for the development of small details in new products, which is not representative as a material patent. This means that, for this thesis, patent counts are not a perfect proxy for innovation. R&D expenditures and the calculated intensity related to the expenditures are generally accepted as proxy for innovation and therefore used in this thesis (Bloch, 2005).

Table 4 gives an overview of the innovation variable. It is expected that R&D intensity will have a positive effect on innovation, whereas previous studies prove otherwise. Based on the effects described above and the written literature, the following hypothesis is formulated:

H2: The probability of a CEO turnover in the near future increases innovation.

Table 4. *An overview of the innovation variables*

Variable	Literature	Expected Effect
Innovation variables		
R&D Intensity	This thesis uses R&D intensity as proxy for innovation investments. R&D intensity is measured by R&D expenditures/total assets. Since CEOs are able to influence the number of patents due to increasing or reducing the R&D budget and patent data is not available after 2006, patents are not accurate as measurement for innovation in this thesis (Lerner and Wulf, 2007). However, R&D intensity is generally accepted as proxy for innovation (Hirschleifer et al., 2012). The general expectation is that innovation increases when R&D intensity increases.	+

3.4 Formulation H3: Forced CEO turnover on innovation

The possible effect of a forced turnover on innovation is explained in this section.

3.4.1 Forced CEO turnover

As mentioned in the literature review, the nature of the change between CEOs is relevant (Bereskin & Hsu, 2014). The CEO does not want to make the same mistake as the former CEO and does not want to end up in the same position. To avoid these mistakes, the new CEO is often willing to invest and innovate more than his or her predecessor (Fisman et al., 2014). Clayton, Hartzell and Rosenberg (2005) support this result and find that forced CEO turnovers are positively related to a higher stock price volatility, indicating that performance has improved. Table 5 gives an overview of the relationship between forced CEO turnover and innovation.

H3: New CEOs after a forced CEO turnover are associated with more innovation.

3.5 Formulation H4: New external CEOs on innovation

The possible effect of a new external CEO on innovation is explained in this section.

3.5.1 Outsider CEOs

Firm performance increases when the new CEO is external (Huson et al., 2004). Outsiders who are new to the organization meet with inexperience in regard to the firm's strategies, available resources and the possibilities to innovate (Datta & Guthrie, 1994). R&D productivity decreases more when the new CEO is an outsider, relative to that when the new CEO is an insider (Cummings & Knott, 2018). The expectation is that new outside CEOs do not immediately know the corporate culture, strategies and policies and therefore decrease innovation performance. Table 5 provides an overview of the effect of new external CEOs on innovation.

H4: New external CEOs lead to less innovation.

3.6 Formulation H5: High confidence CEOs on innovation

The possible effect of high confidence CEOs on innovation is explained in this section.

3.6.1 Confident CEOs

High overconfident CEOs are more likely to invest in innovation projects, mostly in the technological direction (Galasso & Simcoe, 2011). Overconfident CEOs are more influenced by the information of the company's cash flow, which can lead to more risk-taking behavior (Malmendier and Tate, 2005; Hirshleifer et al., 2012). The expectation is that overconfident CEOs will invest more in innovation, because they believe in a positive effect in the future. Previous literature as mentioned above is investigated while the company is not experiencing a CEO turnover. The question is if new CEOs that are confident, also affect innovation. In this thesis, the effect of overconfident CEOs on innovation is measured on a short-term notice. Prior literature showed that overconfident CEOs affect innovation positively, especially on the long-term (Bereskin & Hsu, 2014). Table 5 provides an overview of the effect of CEO overconfidence on innovation.

H5: New overconfident CEOs increases innovation.

Table 5. *An overview of the CEO turnover variables*

Variable	Literature	Expected Effect
CEO turnover	CEO turnover is the change of a CEO, which may lead to a higher innovation performance (Murphy and Zimmerman, 1993).	+
Forced CEO Turnover	Poor firm performance causes forced CEO turnovers (Jenter and Kanaan, 2006). Firing a CEO leads to better returns, because new CEOs are afraid to get fired when they act the same as the former CEO (Fisman et al., 2014; Bereskin et al., 2014).	+
External CEO	External CEO measures the effect of an new outside CEO on innovation, which is expected to be lower than a new inside CEO (Hirshleifer et al., 2012). Inside CEOs are more profitable and so a higher performance occurs after the change of the previous CEO (Zhang, 2008).	-
Overconfident CEO	Innovation performance increases when the CEO is highly overconfident, especially in competitive industries (Galasso and Simcoe, 2011). Overconfident CEOs are willing to take more risk, which leads to more investments in innovation (Malmendier and Tate, 2005).	+

3.7 Control variables CEO turnover on innovation

Additionally, control variables are included in the models to control for the relationship between CEO turnover and innovation (performance), where CEO turnover, forced CEO turnover, new external CEO and overconfident CEO are the independent variable and innovation and innovation performance are the dependent variable. Table 6 gives an overview of the control variables.

Table 6. *An overview of the control variables*

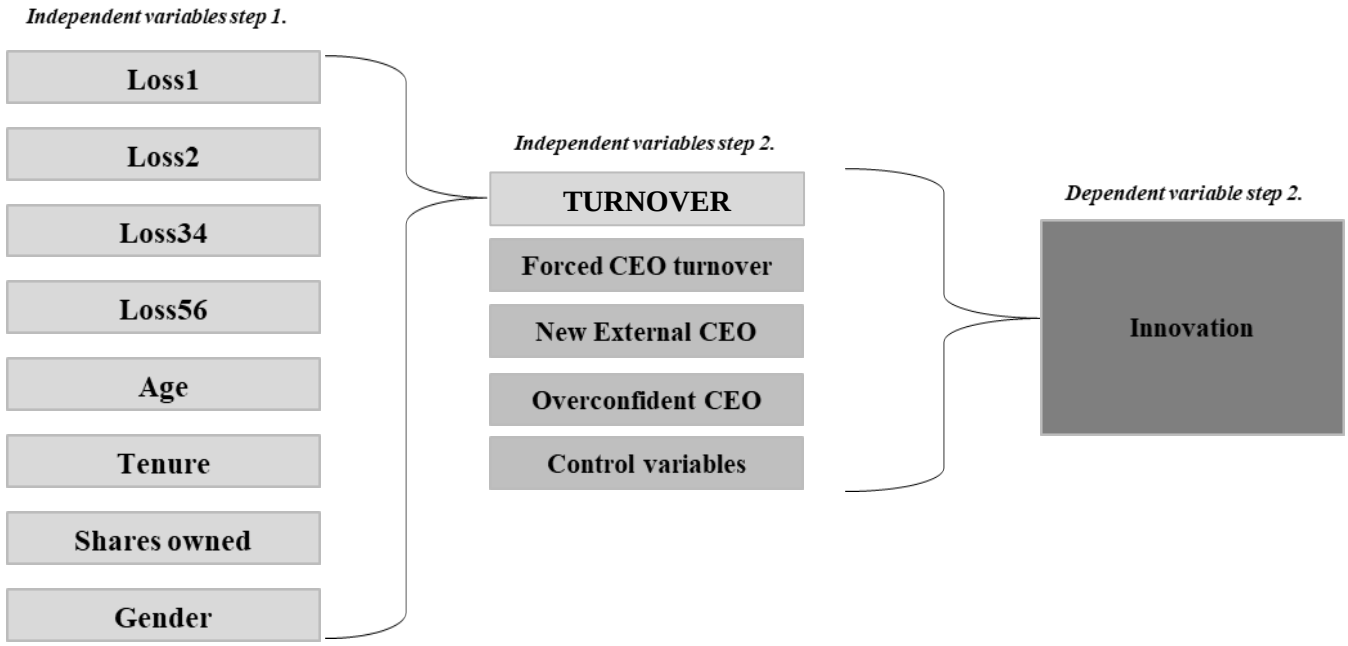
Variable	Literature	Expected Effect
High-tech industry	CEO turnover appears more in homogeneous industries and the turnover is greater in highly competitive industries, which leads to more innovative companies (Parrino, 1997; DeFond and Park, 1999).	+
ROA	Firms with higher return on assets have more opportunities to invest in innovation (Biscotti et al., 2018).	+
Leverage	Leverage can influence the investment policy of an organization and affect the ability to innovate (Barker and Mueller, 2002). More leverage decreases the likelihood of innovation.	-
Firm Size	Larger firms have more opportunities to act in the market through more resources and possibilities. It is likely that these firms have better conditions and opportunities to invest in innovation.	+
Capital Intensity	Capital-intensive firms benefit from the input that employees deliver, and capital intensity is related to the increase of efficiency in problem solving and reducing mistakes at work (Zhang, Chen, Tian, Morris and Fan (2019).	+
MtB Ratio	Market-to-book ratio is expected to have a positive relation with innovation. Since market-to-book ratio is measured as the end of the year stock price minus the book value of the stock, more innovative companies often have a higher market-to-book ratio (Bereskin and Hsu, 2014)	+

4. METHODOLOGY

4.1 Introduction

This chapter explains the methodology, the relevant theory and the statistical aspects of this thesis. As mentioned before, this thesis is building towards the end conclusion in a few different steps. The different research steps of this thesis are explained in figure 1. This is an overview of the variables that are included in this study. The dependent variable and the independent variables related to the first step of this thesis are discussed. Then, the dependent variable and the independent variables of the second part of this study are discussed. Lastly, the sample selection and the research method are explained. At the end I provide a table that includes the description of all the variables used in this study to summarize this chapter.

Figure 1. *An overview of the variables*



4.2 Dependent variable step 1

In this section the dependent variable of research step one is discussed. I explain the dependent variable and how the variable is measured. The sample consists of firms between 2010-2016, which will be further explained in the sample selection section.

4.2.1 CEO Turnover

The dependent variable in the first step of this thesis is CEO turnover. CEO turnover (*Turnover1516*) is measured as a dummy variable that equals one for firms where a CEO turnover took place in 2015 or 2016, following Matêjka et al. (2009). The title CEO is given to the person that was the longest active

CEO in the given year, i.e. when CEO 'x' leaves in October 2014, according to the dataset CEO 'x' is categorized as CEO for the year 2014. This means that the first year of the new CEO is the year 2015 and the firm experiences a turnover in the year 2015. It is also possible that the CEO leaves the firm in March 2015, which means the new CEO is the longest active CEO in 2015 (9 out of 12 months) and is marked as the CEO in the year 2015. To create consistency, a turnover takes place in the first year a new CEO is active for a firm. So, *Turnover1516* equals one for firms that have a new CEO in 2015 or 2016.

4.3 Independent variables step 1

In this section I explain the independent variables consecutive loss years, low profit firms, high profit firms, age, tenure, shares owned and gender and how the variables are measured.

4.3.1 Firm performance

One of the independent variables are the consecutive loss years. As mentioned in the literature review, consecutive loss years increase the likelihood of a CEO change, even if bad firm performance is beyond control of the CEO (Jenter & Kanaan, 2015). According to DeGeorge et al. (1999), the analyses of losses or earnings are used as proxy for (under)performance. To examine the first hypothesis, consecutive loss years, low profit firms and high profit firms are defined to investigate the relation between bad firm performance and CEO turnover. Consecutive loss years consist of multiple years of negative net income. Following Matêjka et al. (2009), firms are categorized into groups that meet certain conditions. *Loss1* is defined as firms that have a loss pattern following a loss in the year 2015 and profits for every year from 2010-2014. *Loss2* is defined as firms that have a loss pattern following a loss in 2014 and 2015 and profits in every year from 2010-2013.

After investigating the results from previous studies, I conclude that after three or four years of consecutive losses the likelihood of CEO turnover is decreasing instead of increasing (Matêjka et al., 2009). One of the possible reasons behind this result is that a CEO will leave the company after two years of bad firm performance (*Loss2*). A new CEO will be given time to express his vision in the company. Also, *Loss3* firms do not have a representative number of CEO changes in this dataset. Therefore, *Loss3* and *Loss4* are combined to investigate if the results differ from previous studies. *Loss3* is defined as firms that have a loss pattern following a loss in 2013, 2014 and 2015 and profits in every year from 2010-2012. *Loss4* is defined as firms that have a loss pattern following a loss in 2012, 2013, 2014 and 2015 and have profits in every year from 2010-2011.

Following the same explanation as for *Loss3* and *Loss4* firms I also combined the variables *Loss5* and *Loss6*. If a CEO change took place after four executive loss years, it is unlikely to assume that a CEO will leave the company in the next year. The CEO will be given time to express his vision and change the company into a winning team. Data showed that *Loss5* firms do not have a representative number of CEO turnovers and will be combined with *Loss6* firms. *Loss5* is defined as firms that have a loss pattern

following a loss in 2011, 2012, 2013, 2014 and 2015 and a profit in the year 2010. *Loss6* is defined as firms that have a loss pattern following losses in every year from 2010-2015. All the firms that are categorized in the groups *Loss1-Loss6* have negative earnings per share.

I also defined high profitable firms (*HighProfit*) that include firms with positive earnings per share for every year, net sales over ten million dollars and an average return on equity of 10% or higher following the approach of Matêjka et al. (2009). High profitable firms are less likely to experience a CEO turnover and this variable is included to examine the difference between firms with bad performance and firms with high profits. High profitable firms could be seen as the control group where it would be unlikely that these firms experience a CEO turnover after highly profitable years.

The last category of performance is the low profit firms (*LowProfit*). Firms with low profits could have the same conditions as firms that experience a loss (Matêjka et al., 2009). *LowProfit* firms are defined as firms that have positive earnings per share for every year, net sales over ten million dollars and an average return on equity below 10%. The difference between low profit firms, high profit firms and firms with consecutive loss years gives a representative view investigating the effect of consecutive loss years on CEO turnover. The variables including consecutive loss years are a proxy for bad firm performance in this thesis.

4.3.2. Age

Age (*AGE*) is a CEO characteristic, a dummy variable that equals one for firms where the leaving CEO in 2014 or 2015 is 60 years or older. If a firm does not experience a CEO turnover in 2015 or 2016, *AGE* equals one for firms that have a CEO that is 60 years or older in the year 2015. It makes sense that CEOs who are approaching the retirement age are more likely to leave the company than younger CEOs (Brickley, 2003). The range of 60 is used because this thesis will investigate if a CEO that approaches the retirement age will leave the company. Previous studies used the retirement age as proxy for age and find that a CEO turnover is 30 percent higher when the CEO is over 64 (Murphy, 1999). To investigate if a CEO is also leaving the company when approaching the retirement age, the range of 60 is used in this thesis. This number is also chosen because each country has a different policy regarding retirement age.

4.3.3 Tenure

Tenure (*TENURE*) is also a CEO characteristic. Mixed evidence is found about CEO tenure. Some studies find that it is less likely that a CEO will leave the company when the experience of the CEO as CEO increases (Kaplan & Minton, 2006). Other studies find that a CEO is more likely to leave the company when he or she has been CEO for a longer time (Lausten, 2002).

TENURE is measured by subtracting the starting year of the CEO from the end year of the CEO. If the leaving CEO has been in place for six years or more in the year 2014 or 2015, *TENURE* equals one for

firms that experience a turnover in 2015 or 2016. If a firm did not experience a turnover in 2015 or 2016, *TENURE* equals one if the CEO has been in place for six years or more in the year 2015. Because the mixed evidence in previous studies, I include this variable to examine the relation between the experience as a CEO and the change in CEO.

4.3.4 Percentage of shares owned

A CEO that owns a greater percentage of shares is less likely to leave the company, according to Matêjka et al. (2009). The CEO with a greater percentage of shares benefits from owning many shares. More power, more dividends and more voting rights are a few examples of benefits by owning a greater percentage of shares. The percentage of shares owned is measured by the log of the percentage of shares owned (*SHARESOWNED*). Using a log-transformed variable of the percentage of shares owned decreases the variability and makes this variable closer to normal distribution (Feng et al., 2014; Matêjka et al., 2009). The value of the leaving CEO in 2014 or 2015 is used for firms with a turnover in the year 2015 or 2016. If the firm did not experience a turnover, the value of *SHARESOWNED* of the CEO in the year 2015 is used for that firm.

4.3.5 Gender

I use gender to examine a CEO turnover and the type of gender. Women are more socially oriented and care more about other people than men (Boulouta, 2013). This means that a female CEO can influence the relation between her and the employees of the company. Including this variable will investigate if gender influences the probability of a CEO turnover. I include *FEMALE* as dummy variable that equals one if the leaving CEO in 2014 or 2015 is a female. If the firm did not experience a turnover in 2015 or 2016 the variable equals one if the CEO was a female in 2015.

4.4 Dependent variable step 2

In this section I explain the next step in this study. The outcome of step one is used to create a predicted probability of a CEO turnover in the near future. This variable is used to examine the relation between a possible turnover and innovation on the short-term.

4.4.1 Innovation

As mentioned in the hypothesis development section, there are a few ways to measure innovation. Previous studies find mixed evidence about the best proxy for innovation. Bereskin and Hsu (2014) find that patent counts and patent cites are the best proxy for innovation. Lerner and Wulf (2007) find that patent counts can be manipulated by the CEO while reducing or increasing the R&D expenditures. This means that R&D expenditures are the reason why innovation can take place. The NBER database provides easily collectible data regarding patents. The downside is that the database includes patent counts until 2006. This thesis needs data from 2010 until 2016 and therefore patent counts or cites are not a representative proxy for innovation in this thesis. The Google patent database can be used instead,

but will take too much time to collect the data by hand. However, previous studies generally accepted and used the level of R&D expenditures or the increase of R&D expenditures as a proxy for innovation (Bloch, 2005; Galasso and Simcoe, 2011; Chen et al., 2014).

In this thesis, innovation is measured by R&D expenditures scaled by total assets, following Hirschleifer et al. (2012). To look if the probability of the CEO turnover affects innovation, I separated the data per firm into two time periods. The first period is determined by the years 2010-2014 and the second period is determined by the years 2015-2016. To examine whether innovation is higher in firms where the probability of a CEO turnover is higher, I calculated the average innovation in the years 2010-2014 and the average innovation in the years 2015-2016. Innovation (*Innovation*) equals one for firms if the average innovation in the years 2015-2016 is higher than the years 2010-2014. This examines if the probability of a CEO turnover in the near future is associated with more innovation. It is to be expected that a CEO turnover will increase innovation.

4.5 Independent variables step 2

In this section I explain the independent variables of step two. Step two consists of the relation between the probability of a CEO turnover and innovation. The variables forced turnover, new external CEO and overconfident CEO are also discussed. The variables in the first step of this research are focused on former CEOs, whereas the variables in step two, except for the predicted probability of CEO turnover, are focused on the new CEOs.

4.5.1 Predicted probability of CEO turnover

The predicted probability of CEO turnover (*TURNOVER*) is, as the title says, the predicted probability calculated from the results of step one. This predicted probability is a proxy for the short employment horizon of a CEO and the likelihood that a CEO change will appear in the near future, following Matêjka et al. (2009). This investigates the relation between the probability of a CEO turnover in the near future and innovation. It is to be expected that innovation increases when firms are more likely to experience a turnover.

4.5.2 Forced CEO turnover

Forced turnover is an indicator that equals one for firms if the new CEO in 2015 or 2016 took place after a forced turnover. A turnover is classified as forced when “the press reports that the CEO is fired, forced out or retires or resigns due to policy differences or pressure” (Parrino, 1997, p. 171). Jenter and Kanaan collected data between the period 1993-2000 of forced turnovers following Parrino (1997). This data was extended by Peters and Wagner between 2001-2016 and has been up to date since then. Using the data from Jenter and Kanaan (2015), Peters and Wagner (2014) and following the approach of Parrino (1997) I matched the data with the dataset in this thesis to identify whether a turnover in 2015 or 2016

was forced. As new CEOs do not want to make the same mistakes as the former CEO, it is expected that new CEOs cause an increase in innovation after a forced departure.

4.5.3 External CEO

External CEOs are CEOs that were not active in the same company before the year they become CEO. External CEOs are more likely to decrease innovation. On the other hand, it is expected that an insider is focused on internal resources because of the deeper identification with the organization (Biscotti et al., 2018). A CEO is determined as external CEO when the year he or she became CEO is the same year as he or she joined the company. An external CEO is measured as a dummy variable that equals one for firms where the new CEO in 2015 or 2016 is an outsider, zero otherwise.

4.5.4 Overconfident CEOs

In this thesis I use the Holder 67 measure following Campbell et al. (2011) and Malmendier and Tate (2005). This measurement is generally used in previous studies to determine whether a CEO is overconfident or not. First, the realizable value per option is calculated. Second, the strike price is determined. Third, the average in-the-money value of the option package is calculated.

The realizable value per option is calculated by dividing the total value of the exercisable, but unexercised options by the total unexercised, but exercisable options. Then the strike price is determined by subtracting the realized value per option of the stock price at the end of the fiscal year. The final step to calculate the average in-the-money value of the option package is to divide the stock price by the strike price and subtract one. After the use of this method by Campbell et al. (2011) the Holder 67 benchmark of Malmendier and Tate (2005) is used. *OVERCONFIDENT* equals one for firms where the average in-the-money value of the option package is 67% or higher for new CEOs in the year 2015 or 2016.

4.6 Control variables

Other variables could also influence the relation between a CEO turnover and innovation. In this section I describe the control variables and how the control variables are measured in this thesis. These control variables are part of the second step in this study.

As mentioned before, the dependent variable is separated into two time periods per firm, 2010-2014 and 2015-2016, to examine the relation between innovation after a CEO turnover. The control variables regarding firm characteristics are treated in the same way to create consistency.

The return on assets can affect the quantity of investments in innovation (Allayannis & Weston, 2001). The return on assets is calculated as the net income divided by total assets. The average ROA (*ROA*) between 2010-2014 and 2015-2016 is calculated to use the return on assets as control variable. The same approach is used with the control variable leverage (*LEVERAGE*), that is calculated as the value

of debt divided by the value of assets. Firm size (*FIRMSIZE*) is calculated as the log of total assets to control for a possible difference between small and large firms related to innovation. Capital intensity (*CAPITALINT*) is included as control variable and is measured by dividing the logarithm of PPE by the number of employees, where PPE stands for Property, Plant and Equipment (Hirschleifer et al., 2012). Market-to-book (*MtBratio*) ratio is a proxy for growth strategy and is measured by subtracting the book-value per share from the share value at the end of the year (Bereskin & Hsu, 2014). A higher market-to-book ratio suggests a better growth strategy and so firms with a higher market-to-book ratio are expected to be more innovative than firms with a lower market-to-book ratio. For the control variable *HIGHTECH* I created a dummy variable that equals one if the firm's SIC code is categorized as a high-tech industry. *HIGHTECH* firms are based on several three-digit SIC codes following Kile and Phillips (2009). Table 7 gives an overview of the SIC codes that are related to high-tech industries.

Table 7. *Thee-digit SIC Code related to High-Tech firms (Kile & Philips, 2009)*

SIC Code	Industry Name
283	Drugs
357	Computer and Office Equipment
366	Communication Equipment
367	Electronic Components and Accessories
382	Laboratory, Optic, Measure, Control Instruments
384	Surgical, Medical, Dental Instruments
481	Telephone Communications
482	Miscellaneous Communication Services
489	Communication Services, NEC
737	Computer Programming, Data Processing, etc.
873	Research, Development, Testing Services

4.7 Equations

To test the hypothesis, I use two regression equations. The equations will be described in this section. As the dependent variables in both steps of this study are binary variables, I use a logistic regression for all hypotheses to identify the relationships between the independent and dependent variables. The first regression will cover the first step of this thesis and is related to hypothesis 1. I expect that bad firm performance increases the likelihood of a CEO turnover. I also expect that a CEO approaching retirement age is more likely to leave the company than a younger CEO. I have mixed expectations regarding CEO tenure. A CEO that is in place for a longer time has more experience and so has better knowledge about the needs of the firm. On the other hand, firms with long-tenured CEOs may lack development. The second equation is related to hypotheses 2, 3 and 4. The proxies for firm performance are the variables of interest in the first equation, whereas *TURNOVER*, *FORCED*, *EXTERNAL* and *OVERCONFIDENT* are the variables of interest in the second equation. I expect more innovation after

a possible CEO turnover, especially if the new CEO is appointed chief executive after a forced turnover. Overconfident CEOs will take more risk in the long-term, whereas the expectation for the effect on the short-term might be different. These equations form the basis of this study. Interactions are not identified in the two equations.

Equation 1. *Logistic regression hypothesis 1*

$$Turnover1516 = \beta_0 + \beta_1 Loss1 + \beta_2 Loss2 + \beta_3 Loss34 + \beta_4 Loss56 + \beta_5 LowProfit + \beta_6 HighProfit + \beta_7 AGE + \beta_8 TENURE + \beta_9 FEMALE + \beta_{10} SHARESOWNED + \varepsilon$$

Equation 2. *Logistic regression hypotheses 2, 3 and 4*

$$Innovation = \beta_0 + \beta_1 TURNOVER + \beta_2 FORCED + \beta_3 EXTERNAL + \beta_4 OVERCONFIDENT + \beta_5 ROA + \beta_6 LEVERAGE + \beta_7 FIRMSIZE + \beta_8 CAPITALINT + \beta_9 MtB + \varepsilon$$

4.8 Sample selection

This thesis contains public North American firms between 2010 and 2016. Previous studies that investigate the relationship between CEO turnover and innovation usually collected data until 2006. The data I need for this thesis include proxies for bad firm performance. Therefore, I start the sample period after the major shocks of the crisis in 2008 in order to prevent for unrepresentative results. The probability that firms experience more losses in the period shortly after the crisis in 2008 is higher than two years after the major shocks. To look at the effects of consecutive loss years I choose a sample with firms that have observations for at least six years from 2010 until 2016. All the data for this period is available. The data includes SIC codes to identify the different industries. As mentioned before, I created a dummy variable for three-digit SIC codes that are identified as high-tech firms.

The first database I use is the CompuStat database to gather firm specific data. This database contains the *net income* to determine the patterns regarding consecutive loss years, *the earnings per share, total sales* and the *total stockholders' equity* to determine the return on equity and the *total assets* and *liabilities* to calculate the return on assets and leverage. To measure innovation, I gather the *research and development expenses* from the database. I collect the *stock price* at the end of the fiscal year as well as the *book value per share* to determine the market-to-book ratio. *Property, Plant and Equipment* and the *number of employees* are collected to measure the capital intensity.

The second database I use is ExecuComp to gather data regarding the CEO characteristics. Executive *names*, *executive id*, *age*, *gender* and *total percentage of shares owned* are collected from ExecuComp. *The annual CEO flag* provides information on the person who was active as CEO in the given year. I

use the *unexercised exercisable options* and the *estimated value of in-the-money unexercised exercisable options* to calculate the realizable value per option, which is needed to measure CEO overconfidence. To measure tenure, I use the *date became CEO* and the *date left as CEO*. I also collect *year joined company* to measure if the new CEO is an external CEO.

The third data source is the *forced turnover* datafile that is developed by Jenter and Kenaan (2015) and has been extended by Peters and Wagner (2014) since then. It contains the dates of forced CEO turnovers of all firms recorded in the ExecuComp database between 1993-2016. The data contains the announcement date of the forced CEO turnover and indicates the earliest instance the turnover is mentioned in the press.

After merging the three datasets, I have 123,844 observations. After dropping observations out of the determined range of 2010-2016, I also drop observations regarding executives who are not CEOs, I drop duplicate CEO observations and I drop missing observations regarding the variables of interest as mentioned above. The total dataset consists of 536 firms with 7 observations per firm (one for each year). The complete dataset consists of 3752 observations in total. Appendix A gives an overview of all the variables as described in this chapter. Appendix B contains the predictive validity framework for the three hypotheses regarding innovation, described in chapter 3. A predictive validity framework shows the variables of interest in a conceptual and operational way. The conceptual part shows the dependent and independent variables and the operational part includes the measurement of the variables. Control variables are added in the fifth box.

5. EMPIRICAL RESULTS AND ANALYSES

5.1 Introduction

This chapter will provide the empirical results and analyses of this thesis. After collecting the data, I will present the descriptive statistics, the correlations and the regression conditions. After using logistic regressions, since the dependent variables are binary variables, I present the results from the regressions.

5.2 Descriptive statistics

The descriptive statistics are presented in table 8. The table shows the number of observations for every variable in steps 1 and 2. As mentioned before, step 1 consists of the dependent variable *Turnover1516* and the independent variables of consecutive loss years, low profit firms, high profit firms, the age of the executive, the tenure of the executive, if the chief executive officer is a female and the percentage shares owned. From this table follows that CEO turnover in 2015 or 2016 has a positive mean score of 0.25. This means that 25% (134) of the companies experience a CEO turnover in 2015 or 2016. There are 34 firms that experience a loss in the year 2015, which is 6.34%. 7 firms (1.31%) experience two consecutive loss years and 13 firms (2.43%) experience three or four years of consecutive losses. 24 (4.48%) firms experience five or six consecutive loss years. A total number of 78 firms (546 observations) experience at least one loss year from 2015. 259 firms belong to the high profit category, whereas 51 firms belong to the low profit category. The remaining number of 148 firms do not belong to one of these categories but are included in the sample to create a representative sample. Leaving these firms in the sample will show that the reason that a CEO left a firm because of consecutive loss years is more reliable. In 38% of the firms the former CEO is 60 years or older before a turnover in 2015 or 2016. In 63.99% of the firms the former CEO was active for six or more years before a turnover in 2015 or 2016. Only 3.5% of the firms experienced a leaving female CEO. The logarithm of the total percentage of shares owned is -0.581.

The average innovation between 2015-2016 is higher than the average innovation between 2010-2014 for 47.38% of the firms. 11% of the turnovers in 2015 or 2016 are forced and 24.25% of the new CEOs after a turnover in 2015 or 2016 are outsiders. 2.7% of the new CEOs after a turnover in 2015 or 2016 are classified as overconfident CEOs. 49% of the companies are classified as a high-tech firms.

Table 8. *Descriptive statistics*

Variable	Obs	Mean	Std. Dev.	Min	Max
		Step 1			
Turnover1516	3,752	0.2500	0.4331	0	1
Loss1	3,752	0.0634	0.2438	0	1
Loss2	3,752	0.0131	0.1135	0	1
Loss34	3,752	0.0243	0.1539	0	1
Loss56	3,752	0.0448	0.2068	0	1
LowProfit	3,752	0.0951	0.2935	0	1
HighProfit	3,752	0.4832	0.4998	0	1
AGE	3,752	0.3800	0.4855	0	1
TENURE	3,752	0.6399	0.4801	0	1
FEMALE	3,752	0.0354	0.1849	0	1
SHARESOWNED	3,752	-0.5814	1.5973	-5.2983	3.9835
		Step 2			
Innovation	3,752	0.4739	0.4994	0	1
FORCED	3,752	0.1101	0.3130	0	1
EXTERNAL	3,752	0.2425	0.4287	0	1
OVERCONFIDENT	3,752	0.0280	0.1650	0	1
ROA	3,752	0.0438	0.1203	-1.4540	0.3622
LEVERAGE	3,752	0.5045	0.2529	0.0486	2.2054
FIRMSIZE	3,752	7.6369	1.8183	2.9292	13.4455
CAPITALINT	3,752	1.8418	6.7374	-101.2593	33.9411
MtBratio	3,752	3.7245	37.7073	-638.4868	1542.2140
HIGHTECH	3,752	0.4907	0.5000	0	1

The table contains descriptive statistics regarding the number of observations, the mean, standard deviation and the minimum and maximum value of observations.

5.3 Results

The results of the binary logistic regression models are discussed. As mentioned before, this thesis consists of two different steps to answer the research question. The first step contains the binary dependent variable *Turnover1516*. An OLS regression is not allowed since the dependent variable is not a continuous variable. For binary variables logistic regressions are used. Binary logistic regressions are used when there is no linear relationship between the dependent and independent variables, which means that the error terms do not need to be normally distributed. This thesis also meets the assumption that the dependent variable is not measured on a ratio or interval scale, because *Turnover1516* and *Innovation* are both a dummy variable that can take a value of 0 or 1.

The results of the first hypothesis are presented in table 10. Model 1 presents the results without interaction between variables and model 2 is included with interaction effects. For the first model the Wald Chi test is significant ($p<0.01$) where $p = 0.000$. This means that every variable is adding value to the model. The first model correctly predicts 76.12% and the second model correctly predicts 76.87%. The pseudo R^2 values are 7.66% and 8.85% respectively. The sample is a random selected dataset. Since independent and control variables are included in the logistic regressions that test the hypothesis, it is important to examine the presence of multicollinearity. The variance inflation factor (VIF) test is normally used to detect multicollinearity within linear models. Previous studies argue about the

assumptions of collinearity. Menard (2002) finds that the assumptions for linear models also hold for binary logistic regressions when identifying multicollinearity. It makes sense that previous studies use the VIF test to detect multicollinearity, since the test is only testing for multicollinearity between the independent variables. The binary dependent variable is not taken into account (Menard, 2002). Therefore, running a VIF test provides legit results to determine multicollinearity.

Table 9. *VIF test hypothesis 1*

Variable	**VIF**	**1/VIF**
HighProfit	1.53	0.6546
SHARESOWNED	1.26	0.7962
LowProfit	1.23	0.8100
TENURE	1.21	0.8255
Loss1	1.18	0.8483
Loss56	1.12	0.8937
Loss34	1.07	0.9362
AGE	1.06	0.9466
Loss2	1.04	0.9636
FEMALE	1.03	0.9720
Mean VIF	**1.17**	

Table 9 provides an overview of the VIF values regarding the independent variables of the first logistic regression. The threshold for multicollinearity differs among previous studies but is generally determined at 10. This thesis uses a boundary of 4, since former researchers argue that a value between 4 and 10 is questionable. The VIF test regarding the first hypothesis is positive with all values below the boundary of 4 and a mean VIF of 1.17. This means that this model is not experiencing multicollinearity issues.

5.3.1 Results part 1

The first hypothesis explains the relationship between bad firm performance and the likelihood of a CEO turnover. A logistic regression is constructed to answer hypothesis 1 *'poor firm performance increases the likelihood of CEO turnover'*. The logistic regression equation is mentioned in section 4.7. The first model is the general model including the consecutive loss years and CEO characteristics. The results will provide the predicted probability of the CEO turnover in 2015 or 2016. The second model is included with two interaction effects to examine if the results are still the same for CEOs in high profitable firms. Both models use the total sample including 3752 observations between 2010-2016 for 536 firms. The pseudo R-squared values are 0.0766 and 0.0885, which means that the variables used in this model explain the dependent variable for 7.66% and 8.85% respectively. Using year fixed effects does not result in other outcomes. The logistic regression coefficients and the p-values are shown in table 10.

From this table follows that, in general, consecutive loss years are positively associated with a CEO turnover in the near future. Firms that have a loss pattern following a loss in 2015 and profits in 2010-2014 have a positive influence on a CEO turnover in 2015 or 2016 of 0.401. This is significant at a 5% confidence level with a p-value of 0.011. A coefficient of 0.401 means that it is 1.49 ($e^{0.401}$) times more likely that a CEO turnover will take place in 2015 or 2016 when the firm experiences a loss in 2015 and profits in 2010-2014 than firms that do not experience this loss pattern. So, the first signal that bad firm performance increases the likelihood of CEO turnover is that this hypothesis is supported. Further examination of the loss patterns is analyzed to provide the final regarding this hypothesis.

Firms that have a loss pattern following losses in 2014-2015 and profits in 2010-2013 are even more likely to experience a turnover in 2015 or 2016. With a coefficient of 2.845 it means that firms with losses in 2014-2015 have 17.20 times more chance to experience a turnover in the near future than firms without this particular loss pattern. It is more likely that a CEO turnover will leave the company after two consecutive loss years than firms that do not experience two consecutive loss years. This is significant at a 1% level ($p = 0.000$). As expected, and mentioned earlier, firms with three or four years of consecutive losses are less likely to experience a turnover in the near future. Previous literature finds that after three or four consecutive loss years, the likelihood of a CEO turnover is lower than after two consecutive loss years. Analyzing the results in table 10 will provide a logical answer to this pattern. The likelihood that a CEO will leave the company after two consecutive loss years is higher than firms that have one loss year. If a CEO is leaving the firm after two consecutive loss years, the new CEO will start the job when the firm experiences bad performance. If a firm experiences one loss year, CEOs will often try to improve the firm performance. Therefore, it is less likely that a CEO will leave after one year of losses than after two years of consecutive losses. After two years of consecutive losses, a new CEO is given time to turn the tide. It makes perfect sense that the new CEO is not leaving one year after becoming CEO. Therefore, at a 5% significance level, it is less likely that firms with three or four consecutive loss years will experience a CEO turnover in 2015 or 2016. Organizations with five or six consecutive loss years have the same outcome as firms with two consecutive loss years. Although the likelihood is lower than firms with two consecutive loss years, it is still significant at a 1% level ($p = 0.000$). Firms with this loss pattern have 2.1 times more chance to experience a turnover in 2015 or 2016 than firms that do not have five or six consecutive loss years.

After analyzing firms that experience bad firm performance it is essential to include profitable firms in the logistic regression to provide a representative answer of hypothesis 1. High profitable firms are less likely to experience a turnover with a negative coefficient of -0.432 ($p = 0.000$). It means that it decreases the odds that a CEO turnover will take place in 2015 or 2016 for high profitable firms. As expected from the theory, the results after analyzing the firm performance support hypothesis 1. Bad firm performance increases the likelihood of a CEO turnover and that result is more reliable after including the high profitable firms that are less likely to experience a turnover in the near future.

Age is positively associated with a CEO turnover in 2015 or 2016 meaning that a CEO who is approaching the retirement age is more likely to leave the firm in the near future. Age is significant at a 0.1% level of confidence with a coefficient of 0.977 ($p = 0.000$) meaning that it is 2.66 times more likely that a CEO who is approaching the retirement age is leaving the company than CEOs who are younger than 60. This result is consistent with previous literature (Barro and Barro, 1990; Matêjka et al., 2009). Tenure is positively associated with turnover stating that a CEO with a longer tenure is more likely to leave the company in the near future. A possible explanation is the boundary of six years of being a CEO. Previous literature finds that it is more likely that CEOs will leave the company until a tenure of 19 years, while a tenure of 20 years or more will decrease the possibility of a CEO turnover (Lausten, 2002). It is less likely that the CEO will leave the company when he or she has a greater percentage of shares owned and this is significant at the 1% level ($p = 0.000$). The coefficient of -0.137 means that it is 0.87 times more likely that a CEO turnover will take place in the near future when the CEO has a greater percentage of shares owned. This indicates that it is less likely to happen ($0.87<1$).

The second model is included with interaction effects to examine the relation between the age of a CEO and high profitable firms and between the tenure of a CEO and percentage of shares owned. Results do not differ for the firm performance variables except for low profitable firms that are not significant in the second model. Approaching retirement age is still significant at a 1% level indicating that it is more likely that a CEO will leave the firm when he or she has the minimum age of 60. According to Matêjka et al. (2009), it is even more likely that a CEO will leave a high profitable firm when approaching the retirement age. In this thesis, I find no evidence that the CEO who is approaching the retirement age is more likely to leave the firm in high profitable firms. To further investigate the relation between tenure and future turnover I created an interaction between tenure and the total percentage of shares owned. When CEOs are active for a longer time in the same firm, it is more likely that they have a greater percentage of shares owned and so it is less likely that he or she will leave the company. CEOs that have more power and receive more dividends are less likely to leave the company. The interaction between tenure and total percentage of shares owned is negatively associated with CEO turnover at a 1% level of significance. Surprisingly, total percentage of shares owned is now positively associated with a CEO turnover where $p = 0.004$ and significant at 1%. This indicates that CEOs who have a greater percentage of shares owned but not a long tenure will be more likely to leave the company in the near future. A possible explanation is that a CEO without a long tenure is not deeply integrated in the company and is emotionally less affected when leaving the company than a long-tenured CEO.

The conclusion after analyzing both models is that bad firm performance increases the likelihood of a CEO turnover, which means that hypothesis 1 is supported. As mentioned before, I use these outcomes in the second part of the results.

Table 10. *Logistic regression hypothesis 1*

	Turnover1516	
	(1)	(2)
Loss1	0.401 *[0.011]***	0.407 *[0.010]****
Loss2	2.845 *[0.000]****	2.906 *[0.000]****
Loss34	-0.620 *[0.043]***	-0.534 *[0.081]*
Loss56	0.734 *[0.000]****	0.735 *[0.000]****
LowProfit	-0.282 *[0.064]*	-0.218 *[0.151]*
HighProfit	-0.432 *[0.000]****	-0.470 *[0.000]****
AGE HighProfit	- -	0.137 *[0.398]*
AGE	0.977 *[0.000]****	0.910 *[0.000]****
TENURE	0.328 *[0.000]****	-0.05 *[0.610]*
FEMALE	0.316 *[0.129]*	0.094 *[0.094]*
SHARESOWNED	-0.137 *[0.000]****	0.143 *[0.004]****
SHARESOWNED TENURE	- -	-0.399 *[0.000]****
_cons	-1.706 *[0.000]****	-1.363 *[0.000]****
N	3752	3752
Pseudo R2	0.0766	0.0885
Prob > chi2	0.000	0.000
Wald chi test (10df)	270.75	-
Correctly classified	76.12%	76.87%

Logistic regression is executed with *Turnover1516* as dependent variable. *The consecutive loss years*, *LowProfit*, *HighProfit*, *AGE*, *TENURE*, *FEMALE* and *SHARESOWNED* are the variables of interest. In the second model interaction effects are included.
* p<0.1; ** p<0.05; *** p<0.01 indicates significance on a 10%, 5% and 1% level respectively.

5.3.2 Results part 2

Innovation is the dependent variable in the second step of this study and is used to answer hypotheses 2, 3 and 4. The measurement of innovation is R&D expenditures divided by total assets. Because *TURNOVER* is a predicted probability of a turnover in the near future, based on a turnover in 2015 or 2016, I separated innovation into two periods inside the firm observations. The first period is 2010-2014 and the second period is 2015-2016. Innovation equals one for firms where innovation in the period 2015-2016 is higher than for the period 2010-2014. Separation of these two periods will answer hypothesis 2 *'CEO turnover increases innovation'*, where the predicted probability is a proxy for the

short employment horizon (CEO turnover) of a CEO. To keep consistency in the model, the *ROA, LEVERAGE, FIRMSIZE, CAPITALINT* and *MtBratio* are also separated into two periods. Following this approach will allow the control variables to control in a consistent way. To check for multicollinearity, the same approach is used as the approach in the previous part. Table 11 gives an overview of the VIF test resulting in no multicollinearity issues. The values are all below 4 with a mean VIF of 1.19.

Table 11. *VIF hypothesis 2,3 and 4*

Variable	**VIF**	**1/VIF**
FIRMSIZE	1.4	0.7161
LEVERAGE	1.37	0.7286
ROA	1.29	0.7750
EXTERNAL	1.24	0.8085
TURNOVER	1.17	0.8543
HIGHTECH	1.14	0.8757
FORCED	1.12	0.8962
CAPITALINT	1.08	0.9274
OVERCONFIDENT	1.08	0.9294
MtB	1.01	0.9937
Mean VIF	1.19	

The results are presented in table 12. Model 1 is the baseline model to answer the three hypotheses. Model 2 is included with high-tech firms and the interaction effect between high-tech firms and a possible turnover. Model 3 includes the same variables as model 2 plus industry fixed effects based on the three digit SIC codes used in the dataset. *HIGHTECH* is excluded in model 3 due to no variances within the industry groups. *HIGHTECH* firms are based on several three digit SIC codes following Kile and Phillips (2009), who identified SIC codes that are related to high-tech industries. The interaction effect between high-tech firms and a possible CEO turnover is included to examine the relation between a turnover in high-tech firms and the possible increase of innovation.

The first model examines the second hypothesis that innovation increases when the likelihood of a CEO turnover increases. The coefficient for the predicted probability of a CEO turnover is 1.106 and significant at the 1% level ($p = 0.000$). The coefficient means that a firm that experienced a turnover in 2015 or 2016 is 3.02 ($e^{1.106}$) times more likely to be innovative than firms that did not experience a turnover in 2015 or 2016. This supports the second hypothesis that CEO turnover increases innovation. Forced CEO turnover is part of the CEO change in 2015 or 2016, where forced means that the former CEO is fired. As mentioned in the previous chapters it is expected that innovation will increase after a forced turnover. New CEOs do not want to use the same approach as the old CEOs and this expectation is supported by the results in table 12. A new CEO that become CEO after a forced departure of the former CEO increases the likelihood of a more innovative organization in 2015 or 2016. This result has

a significance level of 1% (p = 0.000). Although a new external CEO in 2015 or 2016 increases the likelihood of innovation, it is not a significant result. This thesis finds no evidence that a new external CEO decreases innovation. The possible explanation could be that new external CEOs meet inexperience regard to the firms' strategies, resources and therefore the possibilities to innovate (Datta & Guthrie, 1994). The effects of the fact that a new CEO is an outsider can probably not be noticed within a few years' time, because the results do not provide evidence for short-term changes. It could be noticed long-term. A new CEO cannot easily make decisions to stop the innovation projects or reduce the R&D budget. These projects and budgets are focused on the long-term and are planned long time beforehand. The board, which probably agreed to the old CEO's plans, will not allow changes that easily. This could be the beginning of an agency problem, since the new CEO is often less attached to the innovation projects started by the old CEO.

Overconfident CEOs often take more risk than CEOs who are not overconfident. I find evidence that overconfidence is negatively associated with innovation on a short-term notice with a significance level of 1% (p = 0.006). New overconfident CEOs will not invest immediately after becoming CEO and do not want to be titled as a reckless CEO. Overconfident CEOs are also more influenced by the information of the company's cashflow and lead to more risk-taking behavior (Malmendier & Tate, 2005). However, being overconfident does not mean taking unprepared actions and risks. The results indicate that the number of firms that experience more innovation in 2015 or 2016 decreases with a new overconfident CEO. Although previous literature finds that more competitive industries are associated with more overconfident and risk-taking CEOs, the first model does not test for overconfident CEOs in a more competitive industry.

Firm size is also negatively associated with innovation. An explanation is given by Scherer (1980) that a large firm is less threatened by competitors and is less motivated to innovate. Again, in more competitive industries the firm is almost forced to be innovative if the organization wants to keep their place at the top. Large firms also have more people involved in the decision-making process and experience managerial inflexibility (Mansfield, 1971). Therefore, innovation implementation may fail because of these reasons.

The second model presented in table 12 includes the interaction effect between high-tech firms and the possible CEO turnover in 2015 or 2016. The results are almost the same for every variable, except for the significance level related to the return on assets. The *ROA* is negatively associated with a higher innovation in 2015 or 2016 at the 10% significance level, indicating that if the average *ROA* increases it is less likely that a firm will experience more innovation in 2015 or 2016. A possible explanation is that firms do not invest in R&D while net income increases and causes an increase in the return on assets. It could mean that these firms do not feel the necessity to innovate. The interaction effect between high-tech firms and CEO turnover in the near future is not significant indicating that there is no evidence

of more innovation in high-tech firms while experiencing a turnover. This is not in line with the literature that more competitive industries have more innovative companies (Scherer, 1980). A possible explanation is that the second model does not have industry fixed effects to detect differences among industries.

The third model includes industry fixed effects and the results show differences with the first two models. While a forced turnover, return on assets and firm size are significant with the significance level of 1%, the market-to-book ratio is also significant after including industry fixed effects ($p = 0.000$). A higher market-to-book ratio indicates that innovation increases, while stock prices at the end of the year increases. Although the predicted probability of a CEO turnover in 2015 or 2016 is not significant after including industry effects ($p = 0.227$), the interaction effect between the possible turnover and high-tech firms is significant at the 10% level. This indicates that the probability of high-tech firms that experience more innovation in 2015 or 2016 increases after a CEO turnover ($p = 0.073$). The coefficient of 1.188 indicates that it is 3.28 times more likely that the innovative performance of high-tech firms increases if they experience a turnover in 2015 or 2016 than firms that are not related to the high-tech industry.

The explanations regarding the outcomes in the first two models for overconfident CEOs and FIRMSIZE were related to competitive industries. To test if firm size and overconfidence are also positively related to innovation in competitive industries, the fourth model consists of two more interaction effects. Forced CEO turnover is still significant at the 1% significance level ($p = 0.000$). The interaction effect between overconfident CEOs and high-tech firms is not significant, although the overconfidence of CEOs after fixed industry effects is positively associated with innovation. Since the high-tech industry is more competitive than other industries, I find no evidence that innovation is affected by overconfident CEOs in high-tech firms. Although firm size is still negatively associated with innovation, the interaction effect between firm size and the high-tech industry is positively associated with innovation ($p = 0.053$). This is consistent with prior literature as mentioned before, where larger firms in competitive industries are associated with more innovation (Scherer, 1980). The probability of a turnover in 2015 or 2016 is still positively associated with higher innovation in 2015 and 2016 for firms regarding the high-tech industry. This interaction effect has a coefficient of 1.11 with a 1% level of significance.

5.4 Robustness checks

In the robustness section I will execute additional logistic regressions to test for the robustness of the results presented in section 5.3. For the first robustness check I drop several outliers from the sample based on the measurements of variables. This means that the variables are checked as continuous variables. Innovation is measured as R&D divided by total assets and is transformed to a dummy variable afterwards. Since dummy variables do not have outliers (it equals 1 or 0), I use the original measurement of the variables before they are transformed to dummy variables to drop outliers. It concerns the variables of interest in the first and second step of the results section. I drop outliers for the

variables of *consecutive loss years* (net income), *LowProfit* and *HighProfit* (return on equity), *earnings per share, tenure, age, percentage shares owned, innovation (R&D / total assets)* and *overconfidence (average percentage of in-the-money options)*. Appendix C consists of boxplots for all the mentioned variables before and after dropping the outliers. The assumption for outliers is that they must be dropped when causing major differences in the outcomes of the regression models. Since there are no major differences in the results of the basic models (model 1) in table 10 and 12 there is no reason to drop the outliers in the basic logistic regression models (main test).

The results of the first robustness check are presented in appendix D. Table 14 contains the results of the first logistic regression. There are 3150 observations (450 firms) with 7 observations for each firm related to the seven years of data between 2010-2016. Except the differences in significance for *Loss34* and *LowProfit*, there are no major differences between these outcomes and the outcomes presented in table 10. The likelihood of a CEO turnover is still positively associated after a loss pattern following a loss in 2015 and profits in 2010-2014 (p = 0.000). As for high profitable firms, the result is still significant at the 1% level with p = 0.000. The coefficient of -0.499 means that it is less likely that a CEO turnover will appear in high profitable firms in 2015 or 2016 than firms that are not categorized as high profitable firms.

Table 15 contains the results of the second robustness check regarding the second step in this research. There are no major differences between the results of table 12 and table 15. The predicted probability of a CEO turnover in the year 2015 or 2016 is still positively associated with innovation (p = 0.023). A new CEO that is placed after the former CEO got fired is positively associated with innovation at the 1% level of significance (p = 0.001). Overconfident CEOs are negatively associated with innovation, the same result as the logistic regression before dropping outliers. *FIRMSIZE* is still negatively associated with innovation with a coefficient of -0.117 (p = 0.000). The independent variables predict the dependent variable for 9.99% and 1.67% respectively. The pseudo-R^2 is slightly higher for both robustness checks. The second value is equal to the logistic regression in table 12. The models are for 78% and 55.4% correctly classified. This first robustness check provides evidence that the results presented in table 10 and 12 are consistent after changes in the sample.

Table 12. *Logistic regressions hypotheses 2, 3 and 4*

	Innovation			
	(1)	(2)	(3)	(4)
TURNOVER	1.106 *[0.000]***	0.932 *[0.009]***	0.579 *[0.227]*	0.649 *[0.230]*
FORCED	0.503 *[0.000]***	0.529 *[0.000]***	0.692 *[0.000]***	0.665 *[0.000]***
EXTERNAL	0.125 *[0.144]*	0.117 *[0.171]*	-0.070 *[0.505]*	-0.064 *[0.543]*
OVERCONFIDENT	-0.589 *[0.006]***	-0.594 *[0.006]***	0.398 *[0.150]*	0.872 *[0.045]**
OVERCONFIDENT HIGHTECH				-0.831 *[0.141]*
ROA	-0.317 *[0.322]*	-0.575 *[0.079]**	-1.573 *[0.000]***	-1.681 *[0.000]***
LEVERAGE	0.227 *[0.126]*	-0.024 *[0.877]*	-0.234 *[0.243]*	-0.219 *[0.273]*
FIRMSIZE	-0.083 *[0.000]***	-0.087 *[0.000]***	-0.107 *[0.000]***	-0.179 *[0.000]***
FIRMSIZE HIGHTECH	-	-	-	0.104 *[0.053]**
CAPITALINT	-0.003 *[0.544]*	-0.003 *[0.519]*	-0.004 *[0.493]*	-0.004 *[0.470]*
MtBratio	0.004 *[0.038]***	0.003 *[0.057]**	0.013 *[0.000]***	0.013 *[0.001]***
HIGHTECH	-	-0.501 *[0.001]***	-	-
TURNOVER HIGHTECH	-	0.366 *[0.490]*	1.188 *[0.073]**	1.11 *[0.100]**
_cons	0.075 *[0.643]*	0.488 *[0.007]***	-	-
N	3752	3752	3185	3185
Pseudo R2	0.0161	0.0865	0.0353	0.0367
Prob > chi2	0.000	0.000	0.000	0.000
Wald chi test (10df)	79.09	107.61	-	-
Industry fixed effects	No	No	Yes	Yes
Correctly classified	55.38%	58.72%	-	-

Logistic regression is executed with Innovation as dependent variable. *TURNOVER*, *FORCED*, *EXTERNAL* and *OVERCONFIDENT* are the variables of interest. *ROA*, *LEVERAGE*, *FIRMSIZE*, *CAPITALINT* and *MtBratio* are the control variables. In the second model interaction between *HIGHTECH* and *TURNOVER* is included. The third model includes industry fixed effects and the third model is included with interaction effects between *HIGHTECH* and *OVERCONFIDENT*, *FIRMSIZE* and *TURNOVER* respectively.
* p<0.1; ** p<0.05; *** p<0.01 indicates significance on a 10%, 5% and 1% level respectively.

The second robustness check I include is the summarized version of the total sample. I summarized the data for each company, which means that there is one summarized observation for 536 firms. This robustness check will show if the results will follow the same pattern after six observations per firm are excluded. I do not further rely on one observation for each firm in each year from 2010-2016. Following the same direction regarding the coefficients is important, because the significance of results in statistical tests relies too heavily on the sample size (Fan, 2001). This robustness check is executed to determine different outcomes in the direction of the coefficient, i.e. a difference is determined if the coefficient in the total sample size is positive and in the summarized sample size is negative. The results are presented in appendix D, table 16 and 17. Although the results are less significant than the main test, the directions of the coefficients hold under different assumptions. Consequently, the reduced sample size is the main reason for insignificant results, while the directions of coefficients are still the same. However, a few results are significant.

The results for the first hypothesis are presented in table 16. Although there are less significant relations in total, a few are still significant. The likelihood that a firm experiences a CEO turnover in 2015 or 2016 increases after two consecutive loss years. The coefficient of 2.847 indicates that firms that experience two consecutive loss years have 17.23 times more chance to experience a CEO change than firms without two consecutive loss years. High profitable firms are less likely to have a CEO turnover in 2015 or 2016 ($p = 0.096$). CEOs that approach the retirement age are more likely to leave the company and this is also consistent with the main results. The coefficient of age is significant with the value of 0.987 ($p = 0.000$). I also find evidence that CEOs with a greater percentage of shares owned are less likely to leave the company in the future, with a coefficient of -0.136 ($p = 0.059$).

The results for hypotheses 2,3 and 4 are not significant except for the firm size of an organization. Firm size is still negatively associated with innovation. However, the coefficients do have the same direction as the main results, which is evidence that sample size matter. Reducing the sample size to a summarized sample instead of taking every year into account affect the total number of significant relations. Although the results are not significant, the coefficients hold the same direction as the main results. Meaning that a possible turnover in 2015 or 2016 has a positive effect on innovation, but no evidence is found for a significant relation.

5.5. Summary results

This chapter includes the regression results that provide answers to the formulated hypotheses in chapter 3. From the results follows that the first hypothesis can be accepted. The results to test the first hypothesis include evidence that poor firm performance increases the likelihood of CEO turnover. After one, two, five or six consecutive loss years the likelihood that a CEO will leave the organization increases, while it is less likely that a CEO will leave profitable firms. The likelihood of a CEO turnover increases when the CEO is approaching the retirement age and decreases when the CEO has a greater

percentage of shares owned. When the CEO is active for more than six years, the likelihood of a change in CEO increases. However, when a long-tenured CEO has a greater percentage of shares owned, it is less likely that he or she will leave the firm.

The second part of this thesis provides answers to hypotheses 2, 3 and 4. After the calculation of the predicted probability based on the outcomes of step one of this thesis, the second hypothesis can be accepted since a CEO turnover increases the likelihood of innovation. The predicted probability as proxy for CEO turnover in 2015 or 2016 increases the likelihood of more innovation in 2015 and 2016. Innovation also increases when the new CEO is appointed after a forced turnover of the former CEO. This means that the third hypothesis can be accepted. However, no evidence is found that new external CEOs lead to less innovation. New external CEOs do have a negative influence on innovation after controlling for industry fixed effects, but the results are insignificant. Finally, the last hypothesis is also rejected. High overconfident CEOs are negatively associated with innovation on a short-term notice. However, after controlling for industry fixed effects and including an interaction effect between overconfident CEOs and high-tech CEOs, overconfident CEOs are positively associated with innovation. The main results hold after removing the outliers. However, reduced sample sizes after creating a summarized model reduced the number of significant outcomes, although the directions of the coefficients hold.

6. CONCLUSION AND LIMITATIONS

The final chapter contains the findings, contribution, limitations and extensions for future research.

6.1 Summary and contributions

When companies experience changes in their top management, it is one of the most important events a firm experiences (Bereskin & Hsu, 2014). A replaced CEO could cause radical changes in a firm, especially in the investment policies or strategies. Although the consequences of CEO changes are not always detectable for the audience, neither are the reasons behind the CEO turnover. Consequently, previous studies tried to examine the cause of a CEO turnover. Previous literature is often focused on firm performance as a possible explanation for a CEO change. Logically, the likelihood of getting fired when the firm experiences poor firm performance is often higher than in high profitable firms. Although bad firm performance is a reason to change the strategy, it can be related to bad economic conditions or poor industry performance rather than the bad performance of a top management (Kaplan & Minton, 2006). Since companies need to change their strategy to become more profitable, previous literature is also focused on the change after a CEO turnover. Since CEOs are often only interested in the actual numbers at the end of the period, cutting several expenses or investments is the easiest way to present positive numbers at the end of the year. This is negatively associated with the investments in innovation (Manso, 2011). The strategies that a new CEO is willing to implement can cause serious agency problems. To combine these two different research topics, this thesis investigates not only the consequences of a CEO turnover regarding investment in innovation, but also examines the reasons behind the CEO turnover. This requires a stepwise approach to answer the research question of this thesis:

"Does the short employment horizon of a CEO affect innovation performance?"

Consecutive loss years as a proxy for bad firm performance and CEO characteristics are used to investigate the relation between CEO turnover and bad firm performance. The outcomes of this test are used to calculate a predicted probability of a CEO turnover. The predicted probability of the CEO turnover is a proxy for the short employment horizon of a CEO. This first step consists of the dependent variable CEO turnover and the independent variables such as consecutive loss years, low profitable firms, high profitable firms, age, tenure, gender and total percentage of shares owned. The second step contains the effect of CEO turnover on innovation. To answer the research question, a sample of 3752 observations of US firms over the period 2010-2016 is used. The second step of this research consists of the dependent variable innovation and the independent variables are the predicted probability of the outcomes related to step one, forced CEO turnover, new external CEOs and new overconfident CEOs. The control variables are included to control the relation between the dependent and independent variables.

The findings in this thesis suggest that bad firm performance is positively associated with a CEO turnover. The likelihood of a CEO change increases after several consecutive loss years. This is supported by the fact that high profitable firms are less likely to experience a CEO turnover. Although Matêjka et al. (2009) find significant results for every year regarding consecutive losses, this study finds no significant result after three or four years of consecutive losses. A possible explanation is the high probability of a CEO departure after two consecutive loss years, when the newly appointed CEO is given time to implement his or her vision and strategy. Related to previous literature, CEOs approaching retirement age are more likely to leave in the near future, which is the same for long-tenured CEOs. After calculating the predicted probability, I find significant evidence that a CEO departure in the near future increases innovation. This effect is also significant for new CEOs that become CEO after a forced departure of the former CEO. I also find evidence that overconfident CEOs are negatively associated with innovation, but this changes into a positive relation when industry effects and an interaction effect between high-tech firms and overconfidence is included. This study does not find evidence that new external CEOs are associated with less innovation.

The answer to the research question is that CEOs with a short employment horizon affect innovation performance of companies. The reasons of the CEO departure and the CEO turnover itself are related to an increase in innovation. This result holds after the reduced sample regarding outliers, but become insignificant when the sample size is reduced.

This research contributes to the literature in several ways. First, this thesis is focused on the periods before and after a CEO turnover. Previous studies are often only focused on the period before the CEO turnover regarding firm performance and CEO turnover, where other studies are only focused on the period after CEO turnover regarding innovation and CEO change. This study includes both and adds value to the existing literature by examining the connected relation between the periods before and after the CEO turnover, regarding firm performance and innovation. Another contribution to the literature is the sample between 2010-2016. Previous studies including innovation and CEO turnover are generally focused on the periods before 2006. This is often because patent data is available until 2006. This study, without the use of patents, is focused on a more recent period and is therefore more representative.

6.2 Limitations

As mentioned in the contribution section, innovation is often measured by patents regarding the period before 2006. Although there is no accurate data available after 2006 to do patent research, this is the biggest limitation of this thesis. Patent counts are generally accepted as proxy for innovation, which means it could be interesting to compare the outcomes between R&D intensity or patent counts as proxy for innovation. The second option regarding patent data is the Google patent database. Due to time constraints it was not an option to use this database and collect all data by hand. This said, not

using patent data does not mean that R&D intensity is not a verified proxy for innovation. On the contrary, R&D intensity is also generally accepted as proxy for innovation.

The second limitation is the sensitivity to the sample size. This study is focused on the years between 2010 and 2016, where firms are categorized into several groups regarding profitability (loss). This means that this thesis has 7 observations for each firm, one for each year. Reducing the sample size and creating a summarized sample result in insignificant outcomes, indicating that sample size matters. Despite the fact that researchers think significant results rely too heavily on the sample size, which makes the sample size less important, it is still a limitation of this study that results become insignificant after reducing the sample size.

The third limitation is the possibility of an omitted variable bias regarding the outside options of a CEO. The CEO may receive offers from other companies that offer better benefits than with his or her current employer. It could be that bad firm performance, age, tenure, percentage of shares owned and gender are not the main reasons for a CEO to leave the firm. In research, the variable could be included by separating industries and then comparing the average salary of the industry with the salary of the CEO. If the salary of the CEO is below the average salary of the industry, the CEO has better outside options and is more likely to leave the firm than when the salary is above the average salary of the industry.

The fourth limitation is related to firm specific risk. As mentioned in the literature, there is also a risk that innovation does not lead to a positive outcome. Not every investment has a positive outcome. Firm specific risk is not taken into account. Examining firm specific risk is necessary to get an overview of the risks of investments.

The last limitation is the possible non-linearity of the interaction effects. The interaction effects in this thesis should be more related to previous literature. The interaction effects are based on the assumption that firms have other conditions in more competitive industries (Scherer, 1980). I used the high-tech industry as a proxy for a competitive industry. A more detailed study of the most competitive industries would provide more representative results. The interaction term between percentage of shares owned and tenure is not based on previous literature. This may indicate a non-linear relation.

6.3 Future research

One of the possible extensions for future research is to combine R&D intensity with patent counts for a more recent period. If patent data is available for the current time period, the differences between periods could be examined. According to Bereskin and Hsu (2014), patent data is important to analyze the output of innovation. Combining the two proxies will give a more representative overview of the turnover effect on innovation. If this data is available, it is also possible to examine the long-term

effect. This study is focused on the effect on innovation shortly after the CEO change. Future research, including patent data for a longer time, could examine the relationship between those two variables in the long-term.

The second extension for future research is to examine the downside of information. Firm specific risk could be measured to develop a critical view on investments after a CEO turnover. Although firm risk is mentioned in the literature review, the examination of firm specific risk is not taken into account.

Finally, creating new strategies, products or processes is more common in innovative industries. Although this study separates high-tech industry codes, examination by dividing the sample into weights regarding innovativeness will present more representative results (Hirschleifer et al., 2012). Including only high innovative industries in the sample ensures more representative outcomes regarding the relationship between CEO turnover and innovation.

REFERENCES

Abrahamson, E. (1991). Managerial fads and fashion: the diffusion and rejection of innovations. *Academy of Management. The Academy of Management Review, 16*(3), 586-586.

Acs, Z. J., Anselin, L., & Varga, A. (2002). Patents and innovation counts as measures of regional production of new knowledge. *Research Policy, 31*(7), 1069-1085.

Adams, R., Bessant, J., & Phelps, R. (2006). Innovation management measurement: a review. *International Journal of Management Reviews, 8*(1), 21-47.

Aghion, P., van Reenen, J., & Zingales, L. (2013). Innovation and Institutional Ownership. *American Economic Review, 103*(1), 277-304.

Allayannis, G., & Weston, J. P. (2001). The use of foreign currency derivatives and firm market value. *The Review of Financial Studies, 14*(1), 243-276.

Allgood, S., & Farrel, K. A. (2000). The effect of CEO tenure on the relation between fir performance and turnover. *The Journal o Financial Research, 23*(3), 373-390.

Barker, V. L., & Mueller, G. C. (2002). CEO Characteristics and Firm R&D Spending. *Management Science, 48*(6), 782-801.

Barnett, H. G. (1953). *Innovation: the basis of cultural change.* New York: McGraw Hill.

Barney, J. B. (1991). Firm resources and sustained competitive advantage. *Journal of Management, 17*(1), 99-120.

Barro, J. R., & Barro, R. J. (1990). Pay, performance and turnover of bank CEOs. *Journal of Labor Economics, 8*(4), 448-481.

Bart, C. K. (1996). The Impact of Mission on Firm Innovativeness. *International Journal of Technology Management, 11*(3,4), 479-493.

Baysinger, B. D., Kosnik, R. D., & Turk, T. A. (1991). Effects of board and ownership structure on corporate R&D strategy. *The Academy of Management Journal, 34*(1), 205-214.

Bebchuk, L. A., Fried, J. M., & Walker, D. I. (2002). Managerial power and rent extraction in the design of executive compensation. *University of Chicago Law Review, 69*(3), 751-846.

Bebchuk, L., & Grinstein, Y. (2005). The growth of U.S. Executive Pay. *Oxford Review of Economic Policy, 21*(2), 283-303.

Bednar, M. K. (2012). Watchdog or Lapdog? A behavioral view of the media as a corporate governance mechanism. *Academy of Management Journal, 55*(1), 131-150.

Bereskin, F. L., & Hsu, P.-H. (2014). Bringing in Changes: The Effect of New CEOs on Innovation. *Paris December 2011 Finance Meeting EUROFIDAI-AFFI*.

Berle, A. A., & Means, G. C. (1933). *The modern corporation and private property.* New York: Macmillan Co.

Bester, H., & Petrakis, E. (2003). Wages and productivity growth in a competitive industry. *Journal of Economic Theory, 109*(1), 52-69.

Bilton, C., & Cummings, S. (2010). *Creative strategy : reconnecting business and innovation.* John Wiley & Sons. Retrieved from https://www-oreilly-com.eur.idm.oclc.org/library/view/creative-strategy-reconnecting/9781405180191/?ar

Biscotti, A., Mafrolla, E., Del Giudice, M., & D'Amico, E. (2018). CEO turnover and the new leader propensity to open innovation: Agency-resource dependence view and social identity perspective. *Management Decision, 56*(6), 1348-1364.

Björk, J. (2012). Knowledge Domain Spanners in Ideation. *Creativity and Innovation Management, 21*(1), 17-27.

Bloch, C. (2005). Innovation measurement: present and future challenges. *Eurostat Conference*, 8-9.

Blundell, R., Griffith, R., & van Reenen, J. (1999). Market share, market value and innovation in a panel of British manufacturing firms. *Review of Economic Studies, 66*(3), 559-554.

Borokhovich, K. A., Parrino, R., & Trapani, T. (1996). Outside Directors and CEO selection. *Journal of Financial and Quantitative Analysis, 31*(3), 337-355.

Boulouta, I. (2013). Hidden connections: The link between board gender diversity and corporate social performance. *Journal of Business Ethics, 113*(2), 185-197.

Brickley, J. A. (2003). Empirical research on CEO turnover and firm-performance. *Journal of Accounting and Economics, 36*(1), 227-233.

Burke, D. M., & Light, L. L. (1987). Memory and aging: The role of retrieval processes. *Psychological bulletin, 90*(3), 513-4.

Butler, S. A., & Newman, H. (1989). Agency control mechanism effectiveness and decision making in an executive's final year with a firm. *Journal of Institutional and Theoretical Economics (JITE) / Zeitschrift für die gesamte Staatswissenschaft, 145*(3), 451-464.

Campbell, T., Gallmeyer, M., Johnson, S., Rutherford, J., & Stanley, B. (2011). CEO optimism and forced turnover. *Journal of Financial Economics, 101*(3), 695-713.

Carmeli, A., Gelbard, R., & Gefen, D. (2010). The importance of innovation leadership in cultivating strategic fit and enhancing firm performance. *Leadership Quarterly, 21*(3), 339.

Chaganti, R., & Sambharya, R. (1987). Strategic orientation and characteristics of upper management. *Strategic Management Journal, 8*(4), 393.

Chen, H., Luo, W., & Soderstrom, N. S. (2018). Career Concerns and 'Unpaid' Executives. *AAA 2017 Management Accounting Section (MAS) Meeting*. Retrieved from https://ssrn-com.eur.idm.oclc.org/abstract=2822979

Child, J. (1974). Managerial and organizational factors as sociated with company performance part i. *Journal of Management Studies, 11*(3), 175-189.

Clayton, M. C., Hartzell, J. C., & Rosenberg, J. (2005). The impact of CEO turnover on equity volatility. *The Journal of Business, 78*(5), 1779-1808.

Core, J. E., Holthausen, R. W., & Larcker, D. F. (1999). Corporate governance, chief executive officer compensation, and firm performance. *Journal of Financial Economics, 51*(3), 371-406.

Coughlan, A. T., & Schmidt, R. M. (1985). Executive compensation, management turnover and firm performance. *Journal of Accounting and Economics, 7*, 43-66.

Cummings, T., & Knott, A. M. (2018). Outside CEOs and innovation. *Strategic Management Journal, 39*(8), 2095-2119.

Daellenbach, U. D., McCarthy, A. M., & Schoenecker, T. S. (1999). Commitment to innovation: the impact of top management team characteristics. *R&D Management, 29*(3), 199-208.

Damanpour, F. (1991). Organizational Innovation: A Meta-Analysis of Effects of Determinants and Moderators. *The Academy of Management Journal, 34*(3), 555-590.

Datta, D. K., & Guthrie, J. P. (1994). Executive succession: Organizational antecedents of CEO. *Strategic Management Journal, 15*(7), 569-577.

Dean, B. V., & Goldhar, J. L. (1980). *Management of research and innovation.* North-Holland.

Dechow, P. M., & Sloan, R. G. (1991). Executive incentives and the horizon problem: An empirical investigation. *Journal of Accounting & Economics, 14*(1), 51-51.

Degeorge, F., Patel, J., & Zeckhauser, R. (1999). Earnings management to exceed thresholds. *The Journal of Business, 72*(1), 1-33.

Deng, Z., Lev, B., & Narin, F. (1999). Science and Technology as Predictors of Stock Performance. *Financial Analysts Journal, 55*(3), 20-32.

Denis, D. J., & Denis, D. K. (1995). Performance Changes Following Top Management Dismissals. *Journal of Finance, 50*(4), 1029-1057.

Donaldson, L., & Davis, J. H. (1991). Stewardship theory or agency theory: CEO governance and shareholder returns. *Australian Journal of management, 16*(1), 49-64.

Dosi, G. (1988). Sources, Procedures, and Microeconomic Effects of Innovation. *Journal of Economic Literature, 26*(3), 1120-71.

Edler, J., Meyer-Krahmer, F., & Reger, G. (2002). Changes in the Strategic Management of Technology: Results of a Global Benchmarking Study. *R&D Management, 32*(2), 149-164.

Eisenhardt, K. M. (1989). Agency theory: An assessment and review. *Academy of management review, 14*(1), 57-74.

Elder, G. H. (1975). Age differentiation and the life course. *Annual Review of Sociology, 1*(1), 165-190.

Ettlie, J. E., Bridges, W. P., & O'Keefe, R. D. (1984). Organization Strategy and Structural Differences for Radical Versus Incremental Innovation. *Management Science, 30*(6), 682-695.

Fan, X. (2001). Statistical Significance and Effect Size in Education Research: Two Sides of a Coin. *The Journal of Educational Research, 94*(5), 275-282.

Farrel, K. A., & Whidbee, D. A. (2002). The impact of forced CEO turnover on committee structure. *Journal of Managerial Issues, 14*(1), 49-67.

Fawcett, J. J., & Torremans, P. (2011). *Intellectual property and private international law* (2nd. ed.). Oxford: Oxford University Press.

Feng, C., Wang , H., Lu, N., Chen, T., He, H., Lu, Y., & Tu, X. M. (2014). Log-transformation and its implications for data analysis. *Shanghai archives of Psychiatry, 26*(2), 105-9.

Finkelstein, S., & Hambrick, D. C. (1990). Top management team tenure and organizational outcomes: The moderating role of managerial discretion. *Administrative Science Quarterly, 35*(3), 484-503.

Fiordelisi, F., & Ricci, O. (2014). Corporate culture and CEO turnover. *Journal of Corporate Finance, 28*, 66-82.

Fisher, G. (1999, Dec. 25). The New York Times. *Chief Says Kodak Is Pointed in the Right Direction.* (C. H. Deutsch, Interviewer) The New York Times. Retrieved from https://www-nytimes-

com.eur.idm.oclc.org/1999/12/25/business/chief-says-kodak-is-pointed-in-the-right-direction.html: https://www-nytimes-com.eur.idm.oclc.org/1999/12/25/business/chief-says-kodak-is-pointed-in-the-right-direction.html

Fisman, R. J., Khurana, R., Rhodes-Kropf, M., & Yim, S. (2014). Governance and CEO turnover: Do something or do the right thing? *Management Science, 60*(2), 319-337.

Galasso, A., & Simcoe, T. (2011). CEO overconfidence and innovation. *Management Science, 57*(8), 1469-1484.

Geroski, P. A. (1991). Innovation and the sectoral sources of UK productivity growth. *The Economic Journal, 101*(409), 1438-1438.

Geroski, P. A., & Machin, S. (1993). Innovation, profitability and growth over the business cycle. *Empirica : Journal of Applied Economics and Economic Policy - Sponsored by the Austrian Economic Association and the Austrian Institute of Economic Research, 20*(1), 35-50.

Gonzalez-Uribe, J., & Groen-Xu, M. (2017). CEO Contract Horizon and Innovation. Retrieved from https://ssrn-com.eur.idm.oclc.org/abstract=2633763

Griffin, A., & Page, A. L. (1996). PDMA success measurement project: recommended measures for product development success and failure. *The Journal of Product Innovation Management, 13*(6), 478-496.

Gu, F. (2005). Innovation, future earnings, and market efficiency. *Journal of Accounting, Auditing & Finance, 20*(4), 385-418.

Hambrick, D. C., & Fukutomi, G. D. (1991). The seasons of a CEO's tenure. *The Academy of Management Review, 16*(4), 719-742.

Hatzikian, Y. (2015). Exploring the Link between Innovation and Firm Performance. *Journal of the Knowledge Economy, 6*(4), 749-768.

Hauschildt, J. (1991). Zur messung des innovationserfolgs. *Zeitschrift Fuer Betriebswirtschaft, 61*(4), 451-451.

Hauschildt, J. (2004). *Innovationsmanagement* (3rd ed.). München: Vahlen.

Hayes, R. H., & Abernathy, W. J. (2007). Managing our way to economic decline. *Harvard Business Review, 85*(7,8), 138-149.

He, L., & Fang, J. (2016). CEO Overpayment and Dismissal: The Role of Attribution and Attention. *Corporate Governance: An Internation Review, 24*(1), 24-41.

Hellwig, M., & Irmen, A. (2000). Endogenous technological change in a competitive economy. *Journal of Economic Theory, 101*, 1-39.

Herrmann, P., & Datta, D. K. (2006). CEO experiences: Effects on the choice of FDI entry mode. *The Journal of Management Studies, 43*(4), 755-778.

Hirshleifer, D., Low, A., & Teoh, S. H. (2012). Are overconfident CEOs better innovators? *The Journal of Finance, 67*(4), 1457-1498.

Hitt, M. A., Hoskisson, R. E., & Kim, H. (1997). International Diversification: Effects on Innovation and Firm Performance in Product Diversified Firms. *The Academy of Management Journal, 40*(4), 767-798.

Huson, M. R., Malatesta, P. H., & Parrino, R. (2004). Managerial Succession and Firm Performance. *Journal of Financial Economics, 74*(2), 237-275.

Huson, M. R., Parrino, R., & Starks, L. T. (2001). Internal Monitoring Mechanisms. *The Journal of Finance, 56*(6), 2265-2297.

Inderst, R., & Mueller, H. M. (2010). CEO replacement under private information. *The Review of Financial Studies, 23*(8), 2935-2969.

Jalles, J. T. (2010). How to measure innovation? New evidence of the technology-growth linkage. *Research in Economics, 64*(2), 81-96.

Jensen, M. C. (1986). Agency costs of free cash flow, corporate finance and takeovers. *The American Economic Review, 76*(2), 323-329.

Jensen, M. C., & Meckling, W. H. (1976). Theory of the Firm: Managerial Behavior, Agency Costs and Ownership Structure. *Journal of Financial Economics, 4*, 305-360.

Jensen, M. C., & Murphy, K. J. (2004). Remuneration: Where we've been, how we got to here, what are the problems, and how to fix them. *Harvard NOM Working Paper No. 04-28; ECGI - Finance Working Paper No. 44/2004*. Retrieved from https://ssrn-com.eur.idm.oclc.org/abstract=561305

Jenter, D., & Kanaan, F. (2015). CEO turnover and relative performance evaluation. *The Journal of Finance, 70*(5), 2155-2183.

Johannessen, J.-A., & Olsen, B. (2001). Innovation as newness: what is new, how new, and new to whom? *European Journal of Innovation Management, 4*(1), 20-31.

Joos, P., & Plesko, G. A. (2005). Valuing loss firms. *The Accounting Review, 80*(3), 847-870.

Kaplan, S. N., & Minton, A. B. (2006). How has CEO turnover changed? Increasingly performance sensitive boards and increasingly uneasy ceos. *Working paper series, 12465*(12465).

Kile, C. O., & Philips, M. E. (2009). Using industry classification codes to sample high-technology firms: analysis and recommendations. *Journal of Accounting, Auditing & Finance, 24*(1), 35-58.

Klein, A. (1998). Firm performance and board committee structure. *Journal of Law and Economics, 41*(1), 275-303.

Kleinschmidt, E. J., & Cooper, R. G. (1991). The impact of product innovativeness on performance. *The Journal of Product Innovation Management, 8*(4), 240-240.

Kraiczy, N. D., Hack, A., & Kellermanns, F. W. (2015). CEO innovation orientation and R&D intensity in small and medium-sized firms: the moderating role of firm growth. *Zeitschrift für Betriebswirtschaft, 85*(8), 851-872.

Lambert, R. A., Larcker, D. F., & Weigelt, K. (1993). The structure of organizational incentives. *Administrative Science Quarterly, 38*(3), 438.

Lausten, M. (2002). CEO turnover, firm performance and corporate governance: Empirical evidence on Danish firms. *International Journal of Industrial Organization, 20*(3), 391-414.

Laux, V. (2008). Board independence and CEO turnover. *Journal of Accounting Research, 46*(1), 137-171.

Lerner, J., & Wulf, J. (2007). Innovation and incentives: Evidence from corporate R&D. *The Review of Economics and Statistics, 89*(4), 634-644.

Lucas, H. C., & Goh, M. J. (2009). Disruptive technology: How Kodak missed the digital. *Journal of Strategic Information Systems, 18*(1), 46-55.

Malmendier, U., & Tate, G. (2005). CEO Overconfidence and Corporate Investment. *The Journal of Finance, 60*(6), 2661-2700.

Mansfield, E. (1971). *Research and innovation in the modern corporation* (1st ed.). New York: Norton.

Manso, G. (2011). Motivating innovation. *The Journal of Finance, 66*(5), 1823-1860.

Marinovic, I., & Varas, F. (2019). CEO horizon, optimal pay duration, and the excalation of short-termism. *The Journal of Finance, 74*(4), 2011-2053.

Matêjka, M., Merchant, K. A., & van der Stede, W. A. (2009). Employment Horizon and the Choice of Performance Measures: Empirical Evidence from Annual Bonus Plans of Loss-Making Entities. *Management Science, 55*(6), 890-905.

McClelland, P. L., Liang, X., & Barker, V. L. (2010). CEO commitment to the status quo: Replication and extension using content analysis. *Journal of Management, 36*(5), 1251-1277.

Menard, S. W. (2002). *Longitudinal research* (2nd ed., Vols. Ser. Quantitative applications in the social sciences, no. 07-76). SAGE. Retrieved from https://methods-sagepub-com.eur.idm.oclc.org/book/longitudinal-research

Miller, D. (1991). Stale in the Saddle: CEO tenure and the match between organization and environment. *Management Science, 37*(1), 34-52.

Miller, D. (1993). Some organizational consequences of CEO succession. *Academy of Management Journal*, 644-659.

Miller, D., & Shamsie, J. (2001). Learning across the life cycle: experimentation and performance among the Hollywood studio heads. *Strategic Management Journal, 22*(8), 725-745.

Moore, B. (1995). What differentiates innovative small firms?, Innovation Initiative Paper No. 4. *ESRC Centre for Business Research, University of Cambridge*.

Murphy, K. J. (1999). Executive compensation. *Handbook of Labor Economics, 3*, 2485-2525.

Murphy, K. J., & Zimmerman, J. L. (1993). Financial performance surrounding CEO turnover. *Journal of Accounting and Economics, 16*(1-3), 273-315.

Parrino, R. (1997). CEO turnover and outside succession: A cross sectional analysis. *Journal of Financial Economics, 46*(2), 165-197.

Peri, G. (2005). Determinants of Knowledge Flows and Their Effect on Innovation. *The Review of Economics and Statistics, 87*(2), 308-322.

Peters, F. S., & Wagner, A. F. (2014). The Executive Turnover Risk Premium. *The Journal of Finance, 69*(4), 1529-1563.

Pfeffer, J., & Salancik, G. R. (2003). *The external control of organizations: a resource dependence perspective.* Stanford University Press .

Porter, M. (1990). Competitive advantage of nations. *Competitive Intelligence Review, 1*(1), 14.

Pukthuanthong, K., Ullah, S., Walker, T. J., & Zhang, J. (2018). Conflict-induced forced CEO turnover and firm performance. *Managerial Finance, 44*(9), 1134-1154.

Quigley, T. J., & Hambrick, D. C. (2012). When the former CEO stays on as board chair: effects on successor discretion, strategic change, and performance. *Strategic Management Journal, 33*(7), 834.

Rickards, T. (1985). *Stimulating Innovation: A systems approach.* F. Pinter.

Roe, M. J. (2013). Corporate Short-Terminism-- in the board room and in the courtroom. *The Business Lawyer, 68*(4), 68(4), 977-1006.

Rogers, E. M. (1983). *Diffusion of innovations.* New York: Free Press.

Roper, S. (1997). Product innovation and small business growth: a comparison of the strategies of German, U.K. and Irish companies. *Small Business Economics, 9*(6), 523-537.

Ross, S. A. (1973). The economic theory of agency: The principal's problem. *American Economic Association, 63*(2), 134-139.

Şabac, F. (2008). Dynamic incentives and retirement. *Journal of Accounting & Economics, 46*(1), 172-172.

Scherer, F. M. (1980). *Industrial Market Structure and Economic Performance* (2nd ed.). Rand McNally.

Schmookler, J. (1966). *Invention and economic growth.* Cambridge: Harvard University Press.

Shleifer, A., & Vishny, R. W. (1997). A survey of corporate finance. *The Journal of Finance, 52*(2), 737-783.

Sorescu, A. B., Chandy, R. K., & Prabhu, J. C. (2003). Sources and financial consequences of radical innovation: Insights from pharmaceuticals. *Journal of Marketing, 67*(4), 82-102.

Stein, J. C. (1988). Takeover threats and managerial myopia. *The Journal of Political Economy, 96*(1), 61-61.

Strecker, N. (2009). *Innovation strategy and firm performance: an empirical study of publicly listed firms* (1st ed., Ser. Gabler edition wissenschaft : betriebswirtschaftliche studien in forschungsintensiven industrien ed.). Gabler. Retrieved from https://doi-org.eur.idm.oclc.org/10.1007/978-3-8349-9481-3

Sunder, J., Sunder, S. V., & Zhang, J. (2017). Pilot CEOs and corporate innovation. *Journal of Financial Economics, 123*(1), 209-224.

Tan, J. (2001). Innovation and risk-taking in a transitional economy: A comparative study of Chinese managers and entrepreneurs. *Journal of Business Venturing, 16*(4), 359-376.

Thomas, A. S., Litschert, R. J., & Ramaswanny, K. (1991). The performance impact of strategy-manager coalignment: An empirical examination. *Strategic Management Journal, 12*(4), 509-522.

Trajtenberg, M. (1990). A penny for your quotes: Patent citations and the value of innovations. *The RAND Journal of Economics, 21*(1), 172-187.

Tushman, M., & Moore, W. L. (1982). *Readings in the management of innovation.* Boston: Pitman Publishing.

Wang, H., & Chen, W.-R. (2010). Is firm-specific innovation associated with greater value appropriation? The roles of environmental dynamism and technological diversity. *Research Policy, 39*(1), 141-141.

Wang, Z., & Wang, N. (2012). Knowledge sharing, innovation and firm performance. *Expert systems with applications, 39*(10), 8899-8908.

Warner, J. B., Watts, R. L., & Wruck, K. H. (1988). Stock prices and top management changes. *Journal of Financial Economics, 20*, 461-492.

Weisbach, M. S. (1995). CEO turnover and the firm's investment decisions. *Journal of Financial Economics, 37*, 159-188.

Weng, D. H., & Lin, Z. (. (2014). Beyond CEO tenure: The effect of CEO newness on strategic changes. *Journal of Management, 40*(7), 2009-2032.

Wry, T., Adam, C. J., & Aldirch, H. E. (2013). More than a Metaphor: Assessing the Historical Legacy of Resource Dependence and its Contemporary Promise as a Theory of Environmental Complexity. *The Academy of Management Annals, 7*(1), 441-488.

Wu, S., Levitas, E., & Priem, R. L. (2005). CEO tenure and company invention under differing levels of technological dynamism. *The Academy of Management Journal, 48*(5), 859-873.

Yadav , M. S., Prabhu, J. C., & Chandy, R. K. (2007). Managing the future: CEO attention and innovation outcomes. *Journal of Marketing, 71*(4), 84-101.

Zaltman, G. R., Duncan, R., & Holbek , J. (1973). *Innovations and Organizations.* New York: Wiley.

APPENDICES

Appendix A

Table 13. *Variable description*

Variable	Measurement	Source
	Step 1	
CEO turnover	Dummy {1 = for firms that experience a CEO turnover in 2015 or 2016, 0 = otherwise}	ExecuComp
LOSS1	Dummy {1 for firms that have negative EPS in every year and a loss pattern that consists of a loss in 2015 and profits in 2010-2014, 0 = otherwise}	CompuStat
LOSS2	Dummy {1 for firms that have negative EPS in every year and a loss pattern that consists of a loss in 2014-2015 and profits in 2010-2013, 0 = otherwise}	CompuStat
LOSS34	LOSS3: Dummy {1 for firms that have negative EPS in every year and a loss pattern that consists of a loss in 2013-2015 and profits in 2010-2012, 0 = otherwise} LOSS4: Dummy {1 for firms that have negative EPS in every year and a loss pattern that consists of a loss in 2012-2015 and profits in 2010-2011, 0 = otherwise}	CompuStat
LOSS56	LOSS5: Dummy {1 for firms that have negative EPS in every year and a loss pattern that consists of a loss in 2011-2015 and profits in 2010, 0 = otherwise} LOSS6: Dummy {1 for firms that have negative EPS in every year and a loss pattern that consists of a loss in 2010-2015, 0 = otherwise}	CompuStat
LowProfit	Dummy {1 = firms that have a positive EPS for every year, sales over $10 million and an average ROE below 10%, 0 = otherwise}	CompuStat
HighProfit	Dummy {1 = firms that have a positive EPS for every year, sales over $10 million and an average ROE over 10%, 0 = otherwise}	CompuStat
AGE	Dummy {1 = for firms where the former CEO is 60 years or older in 2014 or 2015 before a turnover in 2015 or 2016. If no CEO turnover in 2015-2016, age equals one if the CEO is 60 years or older in 2015, 0 = otherwise}	ExecuComp
TENURE	Dummy {1 = for firms where the former CEO was active as CEO for 6 or more years in 2014 or 2015 before a turnover in 2015 or 2016. If no CEO turnover in 2015 or 2016, tenure equals one if the CEO is active for 6 years or more in 2015, 0 = otherwise}	ExecuComp
FEMALE	Dummy {1 = firms when the former CEO before a turnover in 2015 or 2016 is female, if no CEO turnover in 2015 or 2016 female equals one if the CEO in 2015 is female, 0 = otherwise}	ExecuComp
SHARESOWNED	The natural log of percentage shares owned by the CEO	ExecuComp
	Step 2	
Innovation	Dummy {1 = xrd/sale is higher for the period 2015-2016 than the period 2010-2014, 0 = otherwise}	CompuStat
TURNOVER	Predicted probability, generated out of the results of equation one (chapter 4).	Results equation 1
FORCED	Dummy {1 = firms where the new CEO is placed in 2015 or 2016 after a forced CEO turnover, 0 = otherwise}	Jenter and Kenaan (1993-2000) and Peters and Wagner (2001-2016)
EXTERNAL	Dummy {1 = firms where the new CEO in 2015 or 2016 is external, 0 = otherwise}	ExecuComp
OVERCONFIDENT	Dummy {1 = firms where the new CEO in 2015 or 2016 is overconfident, 0 = otherwise}	ExecuComp / CompuStat
ROA	Average return on assets (net income / total assets) in the periods 2010-2014 and 2015-2016, related to the measure of innovation to create consistency among the variables	CompuStat
LEVERAGE	Average leverage (total assets / total liabilities) in the periods 2010-2014 and 2015-2016, related to the measure of innovation to create consistency among the variables	CompuStat
FIRMSIZE	Average firm size (natural log of total assets) in the periods 2010-2014 and 2015-2016, related to the measure of innovation to create consistency among the variables	CompuStat
CAPITALINT	Average capital intensity (natural log of PPE / number of employees) in the periods 2010-2014 and 2015-2016, related to the measure of innovation to create consistency among the variables	CompuStat
MtBratio	Average market-to-book ratio (stock price end of the year - book value per share) in the periods 2010-2014 and 2015-2016, related to the measure of innovation to create consistency among the variables	CompuStat

Appendix B

Figure 2. *Pv framework hypothesis 2*

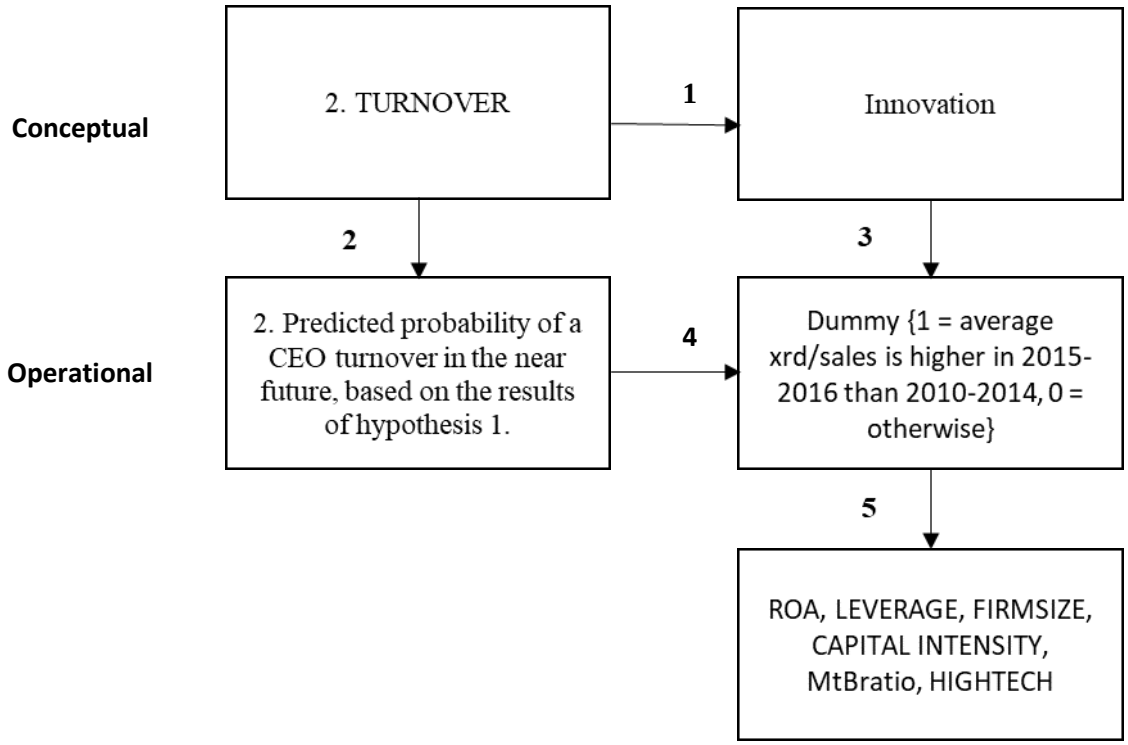


Figure 3. *Pv framework hypothesis 3*

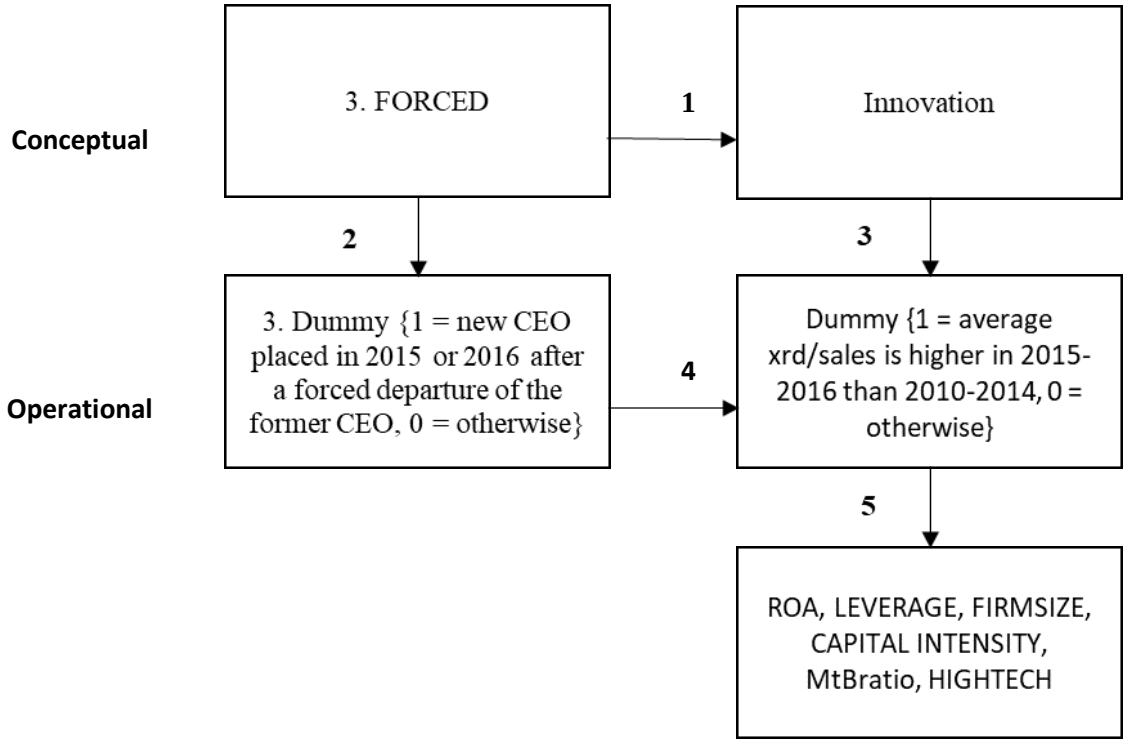


Figure 4. *Pv framework hypothesis 4*

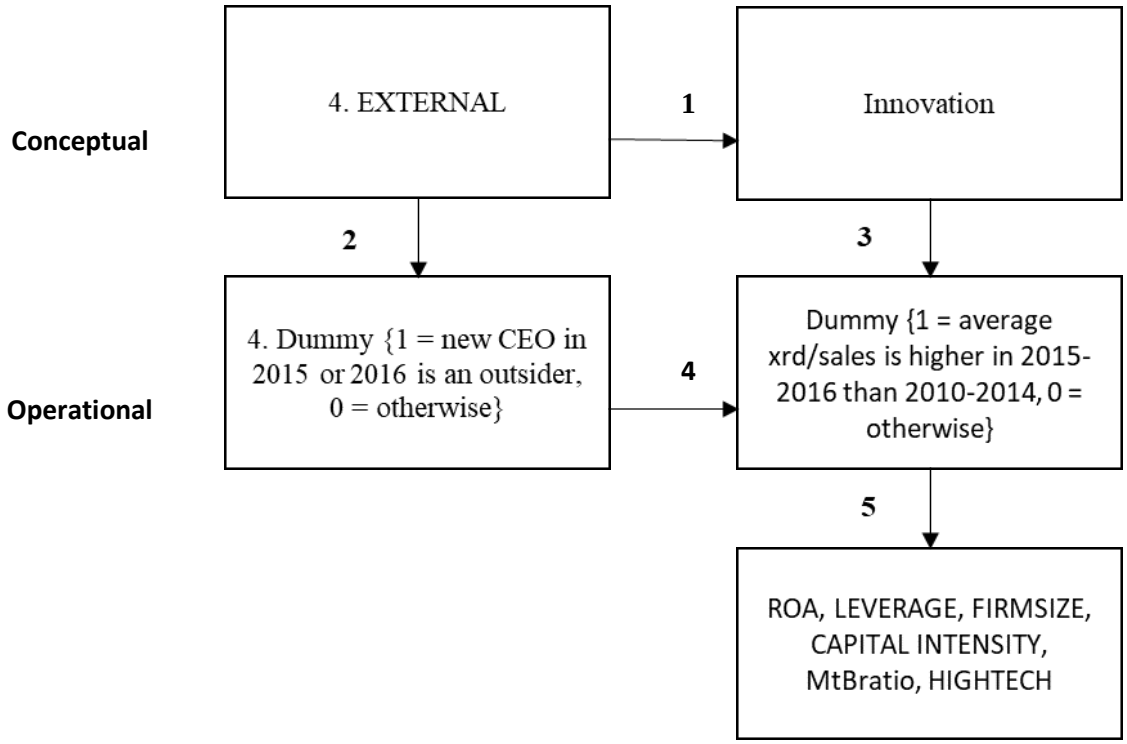
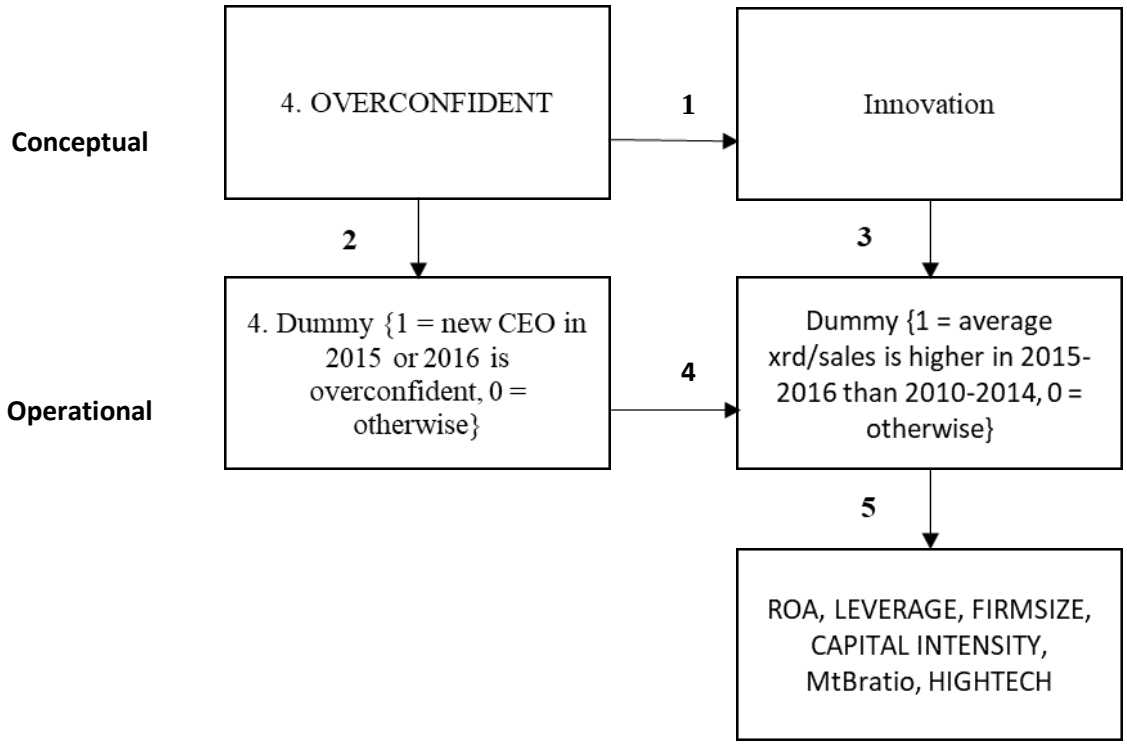


Figure 5. *Pv framework hypothesis 5*



Appendix C

Figure 6. *Box plot net income before and after dropping outliers*

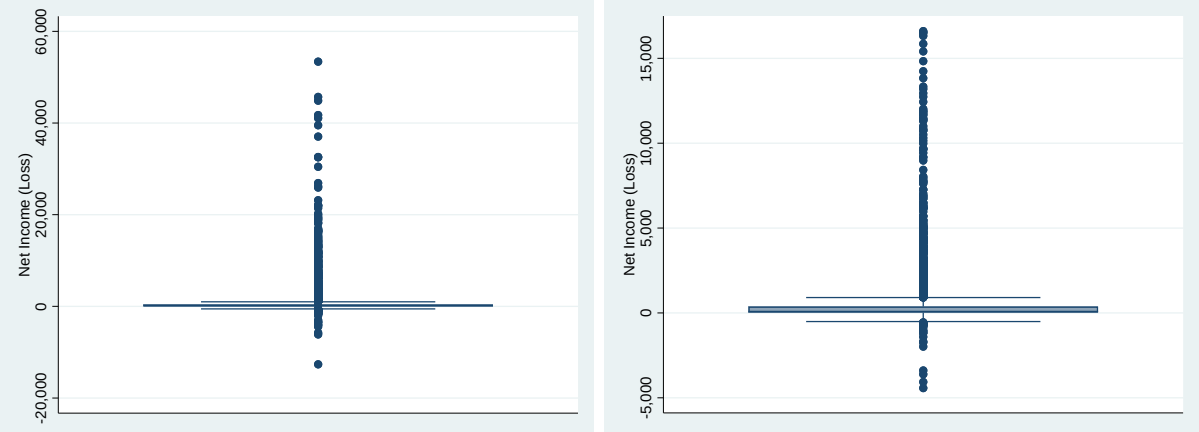


Figure 7. *Box plot ROE before and after dropping outliers*

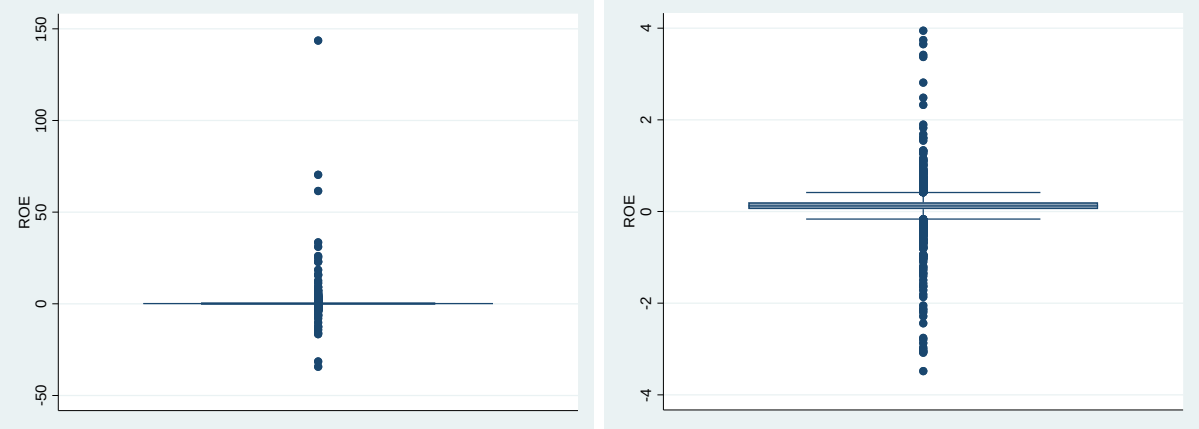


Figure 8*. Box plot EPS before and after dropping outliers*

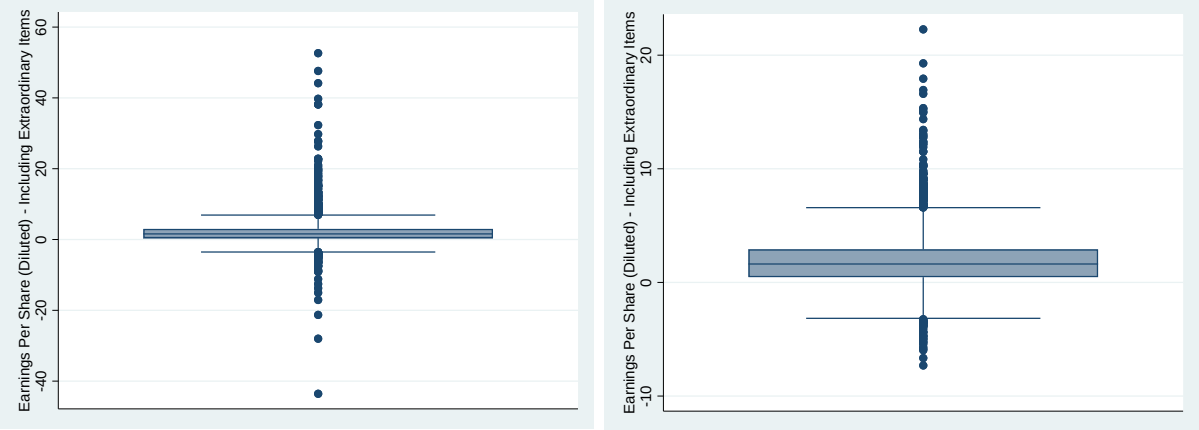


***Figure 9**. Box plot Age before and after dropping outliers*

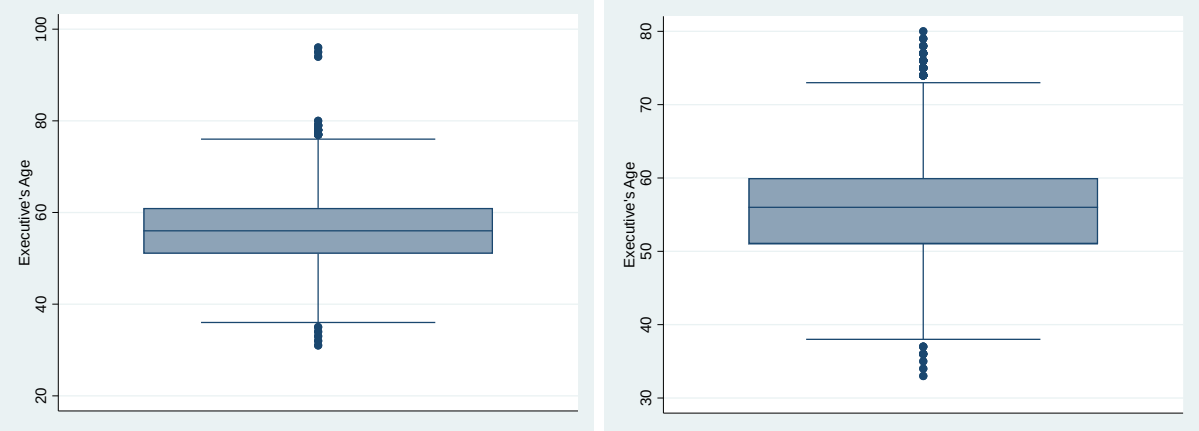


***Figure 10.** Box plot Tenure before and after dropping outliers*

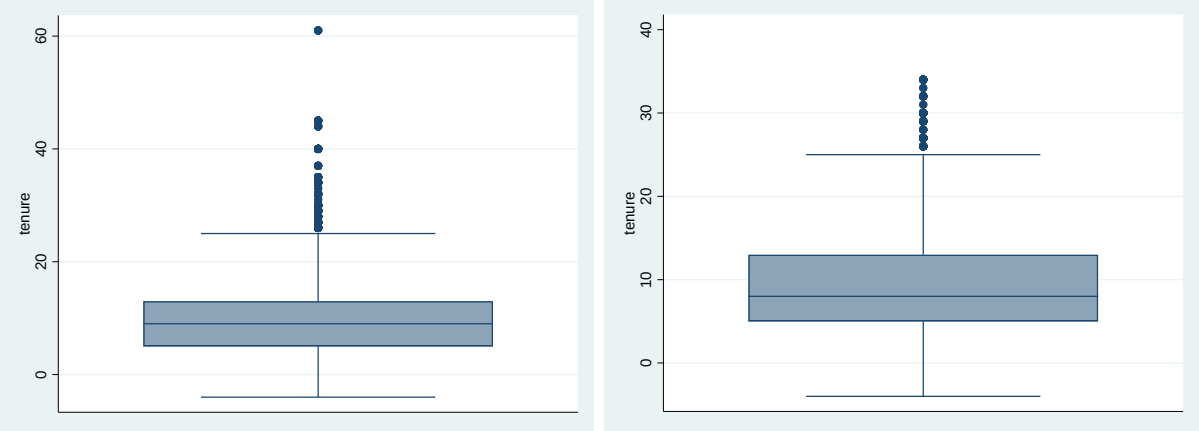


***Figure 11**. Box plot Shares Owned before and after dropping outliers*

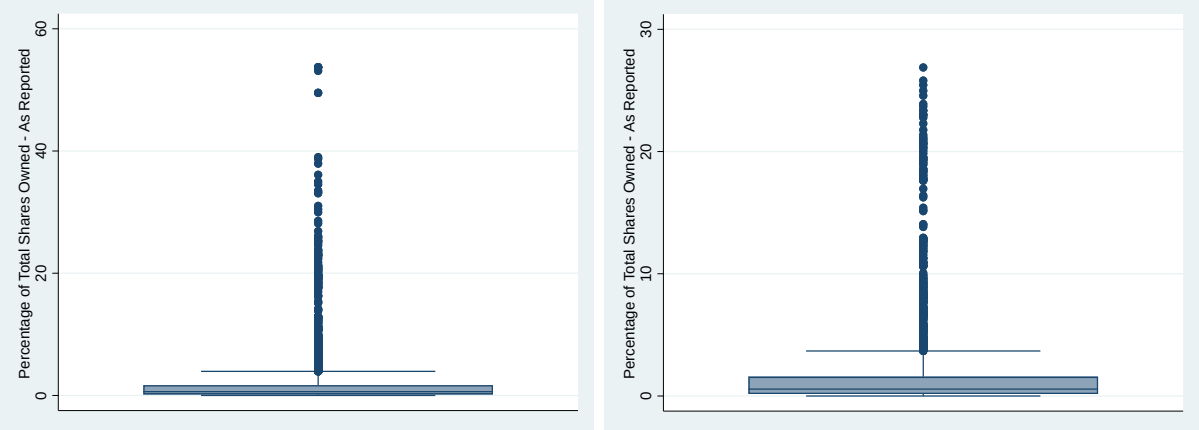


Figure 12. *Box plot Innovation (R&D/AT) before and after dropping outliers*

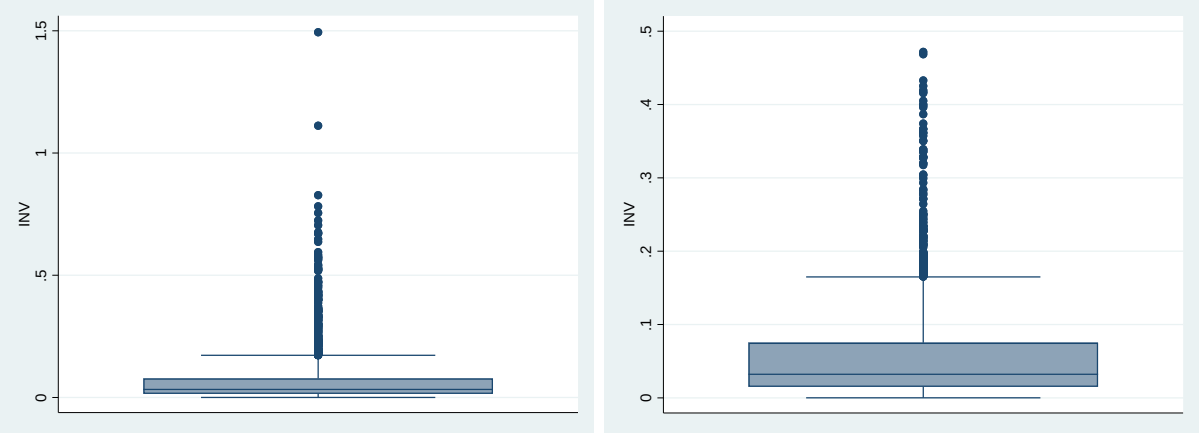
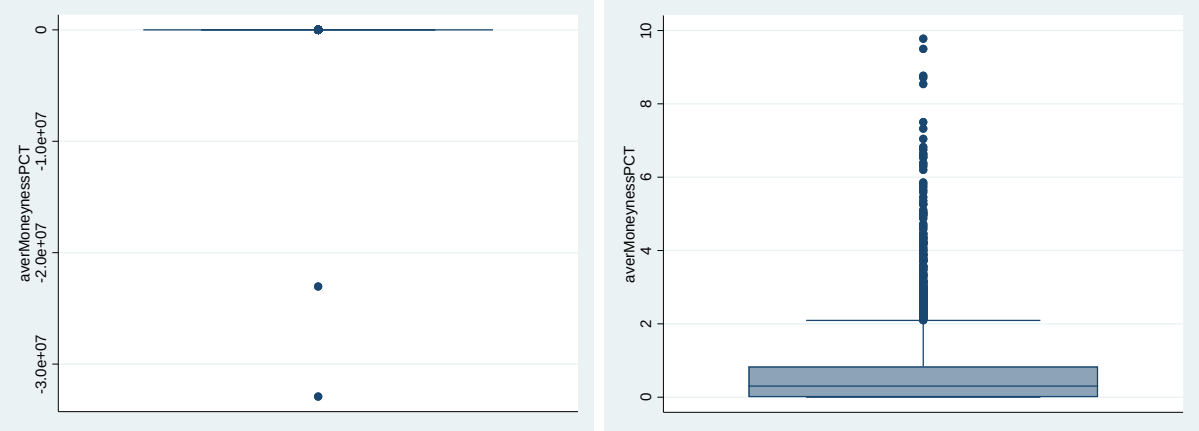


Figure 13. *Box plot Overconfident CEOs (average in-the-money value of options) before and after dropping outliers*



Appendix D

Table 14. *Logistic regression after dropping outliers hypothesis 1*

	Turnover1516
	(1)
Loss1	0.697 *[0.000]***
Loss2	2.782 *[0.000]***
Loss34	-0.432 *[0.173]*
Loss56	1.69 *[0.000]***
LowProfit	-0.274 *[0.095]**
HighProfit	-0.499 *[0.000]***
AGE	1.162 *[0.000]***
TENURE	0.359 *[0.000]***
FEMALE	-0.114 *[0.653]*
SHARESOWNED	-0.138 *[0.000]***
_cons	-1.804 *[0.000]***
N	3150
Pseudo R2	0.0999
Prob > chi2	0
Wald chi test (10df)	298.04
Correctly classified	78%

* p<0.1; ** p<0.05; *** p<0.01 indicates significance on a 10%, 5% and 1% level respectively

Table 15. *Logistic regression after dropping outliers hypotheses 2, 3 and 4*

	Innovation
	(1)
TURNOVER	0.612 *[0.023]***
FORCED	0.408 *[0.001]****
EXTERNAL	0.082 *[0.387]*
OVERCONFIDENT	-0.455 *[0.055]**
ROA	-1.279 *[0.009]****
LEVERAGE	0.226 *[0.224]*
FIRMSIZE	-0.117 *[0.000]****
CAPITALINT	-0.008 *[0.399]*
MtBratio	0.019 *[0.010]****
_cons	0.454 *[0.027]***
N	3150
Pseudo R2	0.0167
Prob > chi2	0.000
Wald chi test (10df)	66.52
Correctly classified	55.4%

* p<0.1; ** p<0.05; *** p<0.01 indicates significance on a 10%, 5% and 1% level respectively

Table 16. *Logistic regression summarized sample size hypothesis 1*

	Turnover1516
	(1)
Loss1	0.401 *[0.338]*
Loss2	2.847 *[0.01]***
Loss34	-0.619 *[0.444]*
Loss56	0.736 *[0.126]*
LowProfit	-0.282 *[0.485]*
HighProfit	-0.433 *[0.096]**
AGE	0.987 *[0.000]****
TENURE	0.326 *[0.185]*
FEMALE	0.317 *[0.564]*
SHARESOWNED	-0.138 *[0.059]**
_cons	-1.710 *[0.000]****
N	536
Pseudo R2	0.0773
Prob > chi2	0
Wald chi test (10df)	39.04
Correctly classified	76.12%

* p<0.1; ** p<0.05; *** p<0.01 indicates significance on a 10%, 5% and 1% level respectively

Table 17. *Logistic regression summarized sample hypotheses 2,3 and 4*

	Innovation
	(1)
TURNOVER	0.845 *[0.255]*
FORCED	0.352 *[0.249]*
EXTERNAL	0.129 *[0.575]*
OVERCONFIDENT	-0.502 *[0.382]*
ROA	-1.399 *[0.115]*
LEVERAGE	0.502 *[0.186]*
FIRMSIZE	-0.138 *[0.015]***
CAPITALINT	0.005 *[0.760]*
MtBratio	-0.002 *[0.577]*
_cons	0.485 *[0.289]*
N	536
Pseudo R2	0.0297
Prob > chi2	0.009
Wald chi test (10df)	18.55
Correctly classified	57.84%

* p<0.1; ** p<0.05; *** p<0.01 indicates significance on a 10%, 5% and 1% level respectively