Erasmus University Rotterdam – Erasmus School of Economics

MSc Accounting, Auditing and Control

CEO tenure and investment efficiency

Student name: Maxim Kaplan
Student number: 484904

Supervisor: E. Voermans
Second assessor: J. Zhang

Abstract
This thesis examines the relationship between CEO tenure and investment efficiency. According to literature, CEOs are responsible for investments, and they have varying level of discretion and oversight during their tenure. Combinations of these factors lead to different phases of a CEO's tenure. In this regard, the first phase and the last phase are especially interesting. In this first phase, CEOs lack knowledge, skills and experience. In the last phase, CEOs become too committed to the status quo so that change becomes difficult to execute. This may have implications for investment efficiency. The research question is therefore: *Do CEOs invest efficiently at both the beginning and the end of their tenure compared to the middle years of their tenure?* To answer this question, I use a two-step approach. First, I predict the deviations from actual investment and then I use multinomial logit models to find the probability that a CEOs overinvests or underinvests compared to investing efficiently. However, I do not find any statistically significant results. Therefore, the research question can be answered affirmatively. The results do not change even with robustness tests. This means CEOs are not more or less likely to overinvest or underinvest as their tenure advances.

Key words: CEO tenure, investment efficiency, overinvestment, underinvestment

Contents

1. Introduction

Chief Executive Officer (CEO) research is based on the fundamental assumption that CEOs matter for organisations (Quigley & Hambrick, 2015). According to the upper echelons theory, firms eventually become reflections of their top executives (Henderson et al., 2006). This thesis examines the relationship between a CEO's tenure, the time a person spends in the position of CEO, and the efficiency of a firm's investments. This is meaningful, because CEOs likely possess discretion with minimal oversight and thus the ability to include personal preferences into a firm's investments (Hambrick & Fukutomi, 1991). Furthermore, the level of discretion and the corresponding oversight are likely to vary across a CEO's tenure (e.g., Barker and Mueller, 2002). Most importantly, CEOs are responsible for investment decisions with investments determining the value of a firm and ultimately a firm's ability to continue operating (Ghosh et al., 2007; O'Brien, 2003). This means that CEOs affect their firms' fates and fortunes by making investing decisions (Hambrick & Fukutomi, 1991). Therefore, more research is needed to understand how investment efficiency varies across a CEO's tenure.

Prior research on the relationship between CEO tenure and investment efficiency is limited. Gan (2019) examines CEO tenure and investment efficiency for the early years of CEO tenure and finds that there is underinvestment in this period. Nevertheless, CEO tenure research has a rich history, providing ample reference points (Darouichi et al., 2021). In this regard, a valuable paper is the one by Hambrick and Fukutomi (1991). These authors created a model that distinguishes between each phase in a CEO's tenure. Especially interesting for investment efficiency, are the first phase and the last phase of a CEO's tenure, corresponding to the early years of CEO tenure and the final years of CEO tenure (e.g., Nguyen et al., 2018). The first phase of CEO tenure is a phase of adaption, where CEOs learn to fulfil their function successfully. The last phase is a phase of decline, whereby CEOs become too committed to the status quo so that change becomes too difficult to consider and execute (Henderson et al., 2006). In support of this theory, Brochet et al. (202) find an inverse u-shaped relationship between CEO tenure and firm value. Given the Hambrick and Fukutomi (1991) model and the relationship between investments and firm value, the behaviour by CEOs in the early years and the final years of their tenure may lead to inefficient investment. Hence, and putting it positively, the following research question is formulated: *Do CEOs invest efficiently at both the beginning and the end of their tenure compared to the middle years of their tenure?*

With regard to the early years of a CEO's tenure, CEO short-termism and the inadequacy of CEO human capital are two factors that may potentially impact CEO investment efficiency. CEO short-termism refers to CEOs being more concerned with short-term firm performance in the early years of their tenure than in the later years of their tenure (Darouichi et al., 2021). This may lead CEOs to invest aggressively early on in their tenure to showcase their ability (Gan, 2019). On top of that, CEOs often start their tenure with a deficit in human capital (i.e., the knowledge, skills and experience required to full their task as CEO successfully). This is the case, even if a CEO has prior experience or is promoted from within the organisation (Hambrick & Fukutomi, 1991). Taking CEO short-termism and the CEO human capital

deficit into account, my first hypothesis states that CEOs invest inefficiently during the early years of their tenure compared to the middle years of their tenure.

With regard to the final years of CEO tenure, three aspects are likely relevant: (1) CEO power and (2) the CEO horizon problem and (3) CEO human capital obsolescence. Power allows CEOs to pursue strategies that maximize their own welfare instead of the company's profits, and also enables CEOs to keep their job (Kor, 2006; Shen, 2003). This means powerful CEOs are likely to be free to pursue inefficient investments without fear of being let go (Ocasio, 1994; Boeker, 1992). The CEO horizon problems refers to CEOs being unmotivated and unwilling to act in the best interest of the organisation when their departure as CEO is near (Darouichi et al, 2021; Kalyta, 2009). Finally, it may also be the case that over time a CEO's knowledge, skill and experience become obsolete (Boeker, 1997; Darouichi et al., 2021). Taking these aspects into account, the second hypothesis in this thesis states CEOs invest inefficiently during the final year of their tenure compared to the middle years of their tenure.

To accept or reject these hypotheses a two-step approach is used. First, a linear regression model is estimated to predict investment. The resulting deviations from actual investment are classified as 'overinvestment', 'efficient investment' and 'underinvestment' based on their magnitude. Second, multinomial logit regressions are used to estimate the probability that a CEO is in the overinvestment group or in the underinvestment group compared to being in the efficient investment group (Biddle et al., 2009). The required data are obtained from merging the Compustat database and the Execucomp database. In line with Ali and Zhang (2015), the early years of a CEO's tenure are defined as the first three fiscal years a CEO is in office, and the final year of CEO tenure is defined as the fiscal year before a CEO leaves office. The final dataset contains 17,038 total observations on 3,545 CEOs from 1,942 firms covering the period 1992-2021. Using this above approach, I do not find any statistically significant results. This means both hypotheses are rejected. CEOs are not more likely to overinvest or underinvest in the early years or the final year of their tenure compared to the middle years. To support these results, two robustness checks are performed, namely controlling for CEO ability and using different predictors of investment. The results remain unchanged.

This thesis contributes to the literature in several ways. First, it sheds more light on investment patterns during a CEO's tenure. Pan et al. (2016) find that as a CEO's tenure increases, the level of investment increases, underinvestment decreases, and the quality of investments becomes lower. However, my study shows that CEOs are not more or less likely to overinvest or underinvest as their tenure advances. Second, Gan (2019) finds that there is underinvestment in the first two years of a CEO's tenure. I find that underinvestment in the first three years is not more likely to occur than in the other periods. This somewhat contradicts Gan (2019)'s findings, as she argues that this underinvestment is due to various reasons unique to the early years of a CEO's tenure. However, given my findings and the fact that similar variables are used, these reasons should not matter. In any case, more research is needed to solve the difference in results between Gan (2019) and this thesis. Third, to my knowledge, no previous studies have examined investment efficiency in the final year of

CEO tenure. I directly add to the literature by finding that CEOs are not more likely to invest inefficiently in this period. These findings can serve as a foundation for future research. All in all, my results are useful to firms. CEOs are not more or less likely to overinvest or underinvest during the early years and final years of their tenure. This means that companies do not need to take any additional actions in these periods to limit opportunistic behaviour using investments (e.g., designing contracts that better align incentives). This saves companies time and money and allows for scarce resources to be put to better use. However, these findings also call for alarm, because various reasons were identified for CEOs to potentially engage in unwanted behaviour. If CEOs do not use investments to achieve their private goals, it may be possible that they use other (potentially unknown) tools. Therefore, more research is needed to study the behaviour of CEOs during their time in office.

2. Literature review

In this section of the thesis the literature will be reviewed and hypotheses will be constructed. First, a general introduction to CEO tenure research will be provided. This introduction discusses the foundations of CEO tenure research and the differences in perspectives between on the one side the management and accounting literature, and on the other side the finance literature. Second, the CEO tenure lifecycle will be discussed. The CEO tenure lifecycle refers to the phases of a CEO's tenure. Third, various aspects of a CEO's tenure will be discussed, giving insight into a CEO's behaviours, motivations and capabilities. Fourth, the outcome variable of this thesis, investment efficiency, will be introduced and discussed. Fifth and final, based on the insights gained from previous sections, the hypotheses will be constructed.

2.1. CEO tenure: A management vs. accounting perspective

Much research has focused on how top executives influence strategic choices and organizational outcomes (e.g., Miller & Shamsie, 2001). The motivation behind this type of research is that firms become reflections of their top executives. This is because managers have limited rationality and firms are influenced by the actions of the top management (Henderson et al., 2006). One type of top executive that is specifically examined in this type of research, is the chief executive officer (CEO) of a firm. CEOs are the highest-level executives in a firm, and their decisions affect a firm's fate and fortune (Hambrick & Fukutomi, 1991). In this thesis, the tenure of a CEO will be examined. The tenure of a CEO is the time a person spends in the position of CEO. The tenure of a CEO is important, because it is a key observable characteristic that predicts both the tendencies and behaviours of a CEO during their time in the office (Hambrick & Fukutomi, 1991). CEO tenure research attempts to identify these tendencies and behaviours and the organizational consequences of specific tendencies and behaviours (Darouichi et al, 2021).

Darouichi et al. (2021)[1] have studied the CEO tenure research literature and summarized the findings and related theoretical insights. According to these authors, historically, there are two streams of CEO tenure research, one in the management literature and one in the accounting and finance literature. Both research streams build on different foundations and examine field-specific themes that lead to different theoretical perspectives. CEO tenure research in management builds on the upper echelons theory by Hambrick and Mason (1984), which states that organizational outcomes can in part be predicted by managerial background characteristics. Following this, CEO tenure research in the management literature mainly focuses on characterising the different 'phases' of a CEO's tenure and the related behaviours, decisions and outcomes. In this context, the seminal paper of Hambrick and Fukutomi (1991) is especially important. Hambrick and Fukutomi (1991) created a model that distinguishes between each phase in a CEO's tenure, whereas earlier research mostly focused on the early and late phases of a CEO's tenure (e.g., Gabarro, 1987). Contrary to management research, the accounting and finance literature perceives CEO tenure mainly in a linear manner. The theoretical foundations come from agency theory, executive contracting theory and executive

[1] Darouichi et al. (2021) applies to the entire paragraph.

myopia theory. For example, agency theory in the context of CEO tenure focuses on how time affects executives' agency and contracting incentives. However, this difference in focus is not clear-cut, as some accounting and finance studies do distinguish between different phases in a CEO's tenure (e.g., Edmans et al., 2012).

For the purpose of this study, the results from both management research and accounting and finance research will be synthesized. This allows for a complete picture of a CEO's behaviour during their tenure.

2.2. The CEO tenure lifecycle

As discussed in the previous section, some studies in the CEO tenure literature focus on identifying distinct phases in a CEO's tenure. The goal of this section is to identify these phases, to serve as a starting point for understanding the related behaviours. An important model of CEO tenure in this regard, is the one put forward by Hambrick and Fukutomi (1991). This comprehensive model of CEO tenure will be discussed in-depth as it is highly prominent in the CEO tenure research literature (Darouichi et al., 2021).

Hambrick and Fukutomi (1991) identify five distinct phases or 'seasons' in a CEO's tenure. These are (1) response to mandate, (2) experimentation, (3) selection of an enduring theme, (4) convergence and (5) dysfunction. These phases will be discussed in order.

The first phase is response to mandate. In this phase the CEO devotes their time to the mandate given by the board of directors or the previous CEO. The mandate is a message, implicit or explicit, about the changes that are expected of a new CEO (Hambrick & Fukutomi, 1991). According to Gabarro (1987) it is a phase of alternating between both learning and action. At the beginning of a CEO's tenure, the learning is expected to be orientational and evaluative. Actions are expected to have a corrective nature. Hambrick and Fukutomi (1991) characterise this phase as the CEO working to develop an early track record, legitimacy and political foothold in the organisation.

The second phase is experimentation. In this phase, CEOs utilize the knowledge they have gained in the previous phase to make major structural changes to the company (Gabarro, 1987). This experimentation can be seen as a form of learning (Miller & Shamsie, 2001). Of course, if the CEO is convinced of the continued correctness of their initial approach to work, this phase may not actually happen in practice (Hambrick & Fukutomi, 1991).

The third phase is the selection of an enduring theme of how the organisation should be run looking forward. The CEO considers what was learned from the previous phases and incorporates the elements that worked best and that were the most comfortable (Hambrick & Fukutomi, 1991). In other words, CEOs find their tone and then become committed to the status quo (Cirillo et al., 2019).

The fourth phase is the convergence phase. In this phase the CEO acts upon the chosen theme through a stream of relatively incremental actions. In other words, the CEO follows through

with their chosen approach to running the business (Hambrick & Fukutomi, 1991). At this point, the company's performance will likely start to drop, as CEOs will become overconfident and less committed to learning (Miller & Shamsie, 2001; Cirillo et al., 2019).

The final phase is the dysfunction phase. In this phase negative effects of a CEO's tenure possibly start to outweigh the positive effects of a CEO's tenure, as eventual mastery of the job may result in boredom, enthusiasm in fatigue, and strategizing in habituation. The CEO will engage in fewer new initiatives and actions. In addition, decision making will become slowed down and will become based upon highly distilled information (Hambrick & Fukutomi, 1991). However, at this point a CEO's power will be at an all-time high. This may allow a CEO to artificially extend their tenure, potentially leading to negative consequences for the organisation (Shen, 2003).

As a conclusion, the picture pained by the model of Hambrick & Fukutomi (1991) is clear. The five discussed phases can be combined into three broader phases. The first phase is a phase of adaption, whereby CEOs learn, partly by doing, and gradually design and implement a strategic orientation that fits both the firm and the environment. The second phase is a phase of relative stability during which the created strategic orientation is maintained. Eventually, though, the third phase ensues. The third phase is a phase of decline that causes firm performance to fall. CEOs become too committed to what worked earlier on in their tenure and to the status quo so that change becomes difficult to consider and execute (Henderson et al., 2006). As support for these phases, Miller (1991) finds that long-tenured CEOs are less likely than their shorter-tenured counterparts to achieve a match between their organisation and the environment. This ultimately results in an inverted u-shape of CEO tenure with regard to firm performance and other measures, such as risk-taking (Henderson et al., 2006; Cirillo et al., 2019). However, it is important to keep in mind that the Hambrick and Fukutomi model (1991) is descriptive, not prescriptive. Also, it describes a lengthy CEO tenure, whereas some CEOs may not even pass the first 'season' (Hambrick & Fukutomi, 1991).

2.3. The impact of CEO tenure on the motivation, power and human capital of CEOs

In this section various aspects of CEO tenure will be discussed. These aspects give further insight into the behaviour of CEOs during their tenure, into important trends of CEO tenure and into the motivation of CEOs. They are based on the themes in the CEO tenure research, as summarized by Darouichi et al. (2021). The aspects are: (1) motivation, (2) CEO power and (3) CEO human capital. They will be discussed in order.

The first aspect of CEO tenure is the motivation of CEOs. Two things to consider are how (1) motivation may be affected by incentives and (2) how motivation may develop over time. First, an extrinsic motivator is compensation (Jensen & Mackling, 1976). Research suggests that CEOs aim to increase their compensation over time, by influencing the board of directors and the compensation committee. This is possible when CEO pay is periodically renegotiated, and when CEOs learn more about the incentive mechanisms during their tenure (Şabac, 2008; Edmans et al., 2012; Marinovic & Varas, 2019). Hill and Phan (2017) find

evidence in support of this theory. They find that when a CEO's tenure increases, it becomes more likely that compensation packages correspond to CEO preferences. Second, CEO motivation might develop over time based on two key trends: (1) CEO short-termism and (2) the horizon problem. Short-termism refers to CEOs being more concerned with short-term firm performance in the early phases of their tenure than in the later phases of their tenure. This happens because CEOs may need to establish legitimacy and convey ability at the start of their tenure (Darouichi et al., 2021). Ali and Zhang (2015) find proof for this hypothesis. They find that CEOs try to influence the market favourably by using earnings management in the early years of their tenure, especially when the market is uncertain about a CEO's ability. Regarding the horizon problem, this problem is about CEOs being unmotivated and unwilling to act in the best interest of the organisation when their departure as CEO is near (Darouichi et al, 2021). Motivation is generally expected to go down over time, as CEOs may eventually become disinterested with their jobs (Hambrick & Fukutomi, 1991). According to Kalyta (2009) the research evidence for this theory is mixed. This author finds that CEOs only engage in earnings management near the end of tenure when post-retirement earnings are dependent on pre-retirement earnings.

The second aspect of CEO tenure is CEO power. Two things to consider are (1) how power allows for CEOs to have discretion and (2) how it also enables CEOs to entrench themselves. CEO power refers to the ability of a CEO to exert their will and to achieve their goals (Shen, 2003). Having power allows for CEOs to have discretion in their work, which enables CEOs to affect organisational outcomes (Hambrick & Fukutomi, 1991). An example of CEOs using their power discretionally is by affecting the capital structure of a firm. Strebulaev and Yang (2013) find that CEO tenure is positively associated with having no debt in a firm's capital structure, especially if boards are smaller and less independent. This implies that CEOs find it easier to implement strategies that fit their own preferences as their tenure advances (Darouichi et al., 2021). Additionally, Wen et al. (2002) find that CEOs get more say on internal control mechanisms as CEO tenure becomes longer. Power also enables CEOs to entrench themselves in their position. Entrenchment refers to the ability of a CEO to hold on to their job. The ability of a CEO to hold on to power is expected to increase over time. This is because, as the CEO meets or exceeds the expectations of the board and powerful stakeholders, the CEO will gain expertise and the opportunity to develop more sources of power. As the CEO proves their ability, the board will likely become confident in the CEO and will become more relaxed and less vigilant, resulting in decreased monitoring. At this point, the CEO can increase control by promoting loyal followers to important position (Shen, 2003). As support, Allen and Panian (1982) find an inverse relationship between CEO power and the likelihood of CEO succession. Additionally, Ocasio (1994) finds a higher rate of CEO succession in the first decade of CEO tenure than in the second decade of CEO tenure.

The third aspect of CEO tenure is the human capital of the CEO. Two things to consider are (1) how a CEO's human capital may accumulate over time and (2) how a CEO's human capital may eventually become obsolete. An important topic is how CEO tenure is related to a CEO's knowledge, skills, expertise and experience over time (Darouichi et al., 2021).

Logically, spending more time in the position of CEO should allow for more learning and therefore greater CEO human capital. In line with this, Graf-Vlachy et al. (2020) argue that CEOs acquire more role-specific knowledge as their tenure advances, resulting in more complex thinking. They find that this is indeed the case, using a CEOs' language patterns as a proxy for cognitive complexity. Additionally, Islam and Zein (2020) find that CEO tenure is positively associated with higher quality innovation, especially when CEOs have hands-on experience inventing in the related technology classes. However, it could also be that CEO abilities and capabilities become obsolete over time (Darouichi et al., 2021). Theoretically, this may be because CEO tenure affects a CEO's cognitions. The longer the tenure of a CEO the more rigid a CEO's cognitive structures become, and the less likely CEOs are willing to accept change (Boeker, 1997). As an example, Miller (1991) finds that in firms with longer-tenured CEOs, there is a reduced match between a firm's strategy and structure, and the environment. This reduced match negatively affects a firm's performance. Additionally, Boeker (1997) finds a negative relationship between CEO tenure and strategic change. However, the shape and nature of these relationships are quite unclear in the literature (Darouichi et al., 2021). For example, Boeker (1997) finds a linear relationship between CEO tenure and organisational change, while Miller and Shamsie (2001) find an inverted u-shape relationship between CEO tenure and product-line experimentation by Hollywood studio heads.

To summarize, there are two trends with regard to the discussed behaviours. CEOs either negatively affect organisational outcomes by being self-interested (e.g., being unmotivated or abusing power), or by lacking the required knowledge, skills and experience (i.e., human capital) to fulfil their function. Also, important to note is that these CEO tenure-related behaviours influence firm performance relatively directly (e.g., through CEO investments). However, CEOs can also influence firm performance through more indirect channels. For example, through creating a unity purpose with internal stakeholders. This boosts employee identification with the firm, potentially leading to improved firm performance (Luo et al., 2014). However. because these mechanisms by nature are complicated and somewhat unclear, they will not be further discussed in this thesis.

2.4. Investment efficiency

The goal of this thesis is to examine whether CEOs invest efficiently during the different phases of their tenure. This is important, because investment efficiency has both macro-economic implications (e.g., the relationship between investment and growth) and firm-level implications (e.g., investment is a determinant of the return on capital obtained by investors) (Biddle et al., 2009). The phases of a CEO's tenure have been discussed extensively in the previous section. In this section 'investment efficiency' will be introduced and discussed.

Theoretically, investing efficiently means that capital flows to its most highly valued use (Kothari et al., 2010). This ensures that firm (net present) value is maximized, which according to neoclassical theories of investment is a firm's main objective (Gao & Yu, 2020). However, as this definition is quite abstract, the term is operationalized in line with Biddle et

al. (2009). This results in the following definition: a firm is defined as investing efficiently if it undertakes projects with positive net present values, assuming there are no market frictions.

However, investment efficiency as a concept is not as straightforward as it may seem. This is because investment decisions can be very complex. For example, a practitioner needs to identify an opportunity to invest, to decide on the optimal level of investment and whether to distribute the investment over time to keep up with the market's demands (Dixit & Pindyck, 1994). In neoclassical theories of investment, the only driver of a firm's capital investment is the marginal Q ratio (Biddle et al., 2009). The marginal Q ratio is the rate that equates the marginal adjustment cost of installed capital to the marginal value of installed capital. This is the ratio of the market value of new additional investment goods to their replacement costs (Gao & Yu, 2020).

Though, according to Biddle et al. (2009), the literature acknowledges that deviations from the optimal level of investment, as determined by the marginal Q ratio, are possible. This implies that firms can overinvest and underinvest relative to the optimal level of investment. Following this, Biddle et al. (2009) operationalize underinvesting as passing up on positive net present value projects and overinvesting as investing in negative net present projects. This deviation from the optimal investment level may happen because of frictions in the market (Chen et al, 2017). With regard to these capital market frictions, two have been widely examined in the literature. These capital market frictions are information asymmetry and agency problems (Benlemlih & Bitar, 2016).

Information asymmetry refers to managers having inside information relative to the potential investors of a company. In such a scenario, it may be the case that positive net value projects that require a share issuance to finance are forgone, because the costs to individual shareholders of issuing shares at a discount are too high. This will result in investors perceiving shares issuances as 'bad news' and therefore in shares being sold at a discounted price. This may ultimately lead to positive net present value projects being forgone and, therefore in underinvestment (Myers & Majluf, 1984; Benlemlih & Bitar, 2016).

The second capital market friction is agency costs. In contrast to the information asymmetry perspective that views managers as acting in the shareholder's best interest, the agency cost perspective views managers as inherently self-interested (Benlemlih & Bitar, 2016; Chen et al, 2017). Managers maximize their own welfare by choosing investment opportunities that are not in the best interest of the shareholders, but are in their own best interest (Jensen & Mackling, 1976). Following this, Benlemlih and Bitar (2016) argue that the resulting poor project selection will result in inefficient investment. In support of this, Jensen (1986) reasons that having cash flows in excess of what is needed to finance positive net present value projects will result in overinvestment, so as to increase managerial power.

To summarize. the prevailing view of this thesis, based on the previous sections, is that CEOs are inherently self-interested. CEOs care about their own welfare and will exploit their power for their own benefit. Together with CEO human capital imperfections, this attitude may lead

to inefficient investment. This means that this thesis is aligned with the second capital market friction, agency costs. With regard to other capital market friction, information asymmetry, I do not consider it relevant for this thesis. This is because it is not something caused by the behaviour of a CEO during their tenure, but it is a result of inefficient capital markets out of the CEO's control.[2] Therefore, information asymmetry will not be further discussed.

2.5. Hypotheses

In this section of the thesis, the hypotheses will be constructed. These hypotheses are based on the previous literature review and relevant research papers. I have chosen to examine the early years of CEO tenure and the final year of CEO tenure. The early years of CEO tenure usually last around two-and-a-half years to three years (Gabarro, 1987). In line with Ali and Zhang (2015), the final year of CEO tenure is the year before the CEO leaves office. These periods are chosen, because, in line with the model of Hambrick and Fukutomi (1991), researchers find a u-shaped relationship between CEO tenure and firm value (e.g., Brochet et al., 2021).

The early years of CEO tenure correspond to the first phase of the Hambrick and Fukutomi (1991) model. With regard to this phase, two aspects of CEO tenure are likely very relevant: (1) CEO short-termism and (2) the inadequacy of CEO human capital.

CEO short-termism refers to CEOs being more concerned with short-term firm performance in the early years of their tenure than in the later years of their tenure. This is because CEOs need to establish legitimacy and convey their ability (Darouichi et al., 2021). According to Ali and Zhang (2015) this is because a high market-perception of CEO ability is associated with long-term benefits such as higher future compensation, reappointments and managerial autonomy. Following this, they find that CEOs use earnings management to favourably influence the market-perception of their ability in the early years of their tenure. In the same line, one can argue that CEOs may favour (dis)investments that pay-off in the short-term, but are potentially unprofitable in the long-run. To support this, Weisbach (1995) finds that there is a higher probability that new CEOs divest an acquisition at a loss or divest an acquisition that is considered unprofitable by the press. Additionally, Du and Lin (2011) find that new CEOs with shorter organizational tenure are associated with higher research and development investments and advertisement investments. These findings indicate that CEOs may invest aggressively early on in their tenure to showcase their ability, ultimately leading to overinvestment (Gan, 2019).

However, it may be the case that CEOs are not able to overinvest due to increased monitoring by the board of directors early on in their tenure and due to lacking power (Shen, 2003). In support of this, Dikolli et al. (2014) find that the probability of a performance-turnover dismissal decreases with CEO tenure. Nevertheless, in a setting where investment decisions are being considered, this monitoring can be somewhat counteracted by distorting the

[2] Nevertheless, the CEO can reduce information asymmetry, but this an entirely different topic. See for example Biddle et al. (2020) on how financial reporting quality can increase investment efficiency.

information provided to the board. This disallows the board from providing valuable advice, ultimately leading to poor investment decisions (Song & Thakor, 2006; Adams & Ferreira, 2007).

With regard to CEO human capital, CEOs start their job with a deficit in the knowledge, skills and experience required to full their task as CEO successfully. This is the case, even if a CEO has prior experience or is promoted from within the organisation (Hambrick & Fukutomi, 1991). This may lead to CEOs becoming conservative and reluctant to invest, in fear of revealing their true ability. This may then ultimately lead to underinvestment (Gan, 2019). To support this, Chen and Zhang (2014) find that risk-taking increases with CEO tenure.

Based on the previous discussion, I formulate the following hypothesis:

Hypothesis 1: CEOs invest inefficiently during the early years of their tenure compared to the middle years of their tenure.[3]

The final year of CEO tenure corresponds to the last phase of the Hambrick and Fukutomi (1991) model. With regard to this phase, three aspects of CEO tenure are likely to be relevant: (1) CEO power and (2) the CEO horizon problem and (3) CEO human capital obsolescence.

CEO power refers to the ability of a CEO to exert their will and to achieve their goals (Shen, 2003). Power allows CEOs to pursue strategies that they like even if they are not profit maximizing choices and also enables CEOs to extend their tenure beyond what is beneficial to the organisation (Kor, 2006; Shen, 2003). As an example, Jensen (1986) reasons that having cash flows in excess of what is needed to finance positive net present value projects will result in empire building. If the CEO has enough power and firm performance stays at acceptable levels, the board will not intervene in such a scenario (Ocasio, 1994). Even if firm performance drops, the CEO can blame that this is because of factors beyond their control, or they can scapegoat other executives (Boeker, 1992). To summarize and link this with investment efficiency, when CEOs have enough power, they are free to pursue inefficient investments (such as empire building investments), without fear of being reprimanded or fired.

The CEO horizon problem refers to CEOs being unmotivated and unwilling to act in the best interest of the organisation when their departure as CEO is near (Darouichi et al, 2021). For example, Barker and Mueller (2002) find that CEOs shape research and development investments to their own preferences, rather than organization preferences, as CEO tenure becomes longer. Additionally, Naaman and Sun (2022) find a negative relationship between CEO tenure and investments in research and development. Of course, according to Zhang et al. (2008), it may also be the case that CEOs do not engage in unwanted behaviour near the

[3] I compare CEO investment efficiency with the middle years of CEO tenure, because, as I will argue next, CEOs may also invest inefficiently during the final year(s) of their tenure.

end of their tenure to protect their reputations. However, they find that longer-tenured CEOs engage in earnings management, especially when some benefits are deferred to after the CEO leaves office.

Finally, it may also be the case that over time a CEO's knowledge, skill and experience become obsolete (Darouichi et al., 2021). For example, Boeker (1997) finds that a CEO's cognitive structure becomes more rigid as CEO tenure advances. Additionally, Miller (1991) finds that in firms with longer-tenured CEOs, there is a reduced match between a firm's strategy and structure, and the environment.

Based on the previous discussion, I formulate the following hypothesis:

Hypothesis 2: CEOs invest inefficiently during the final year of their tenure compared to the middle years of their tenure.

3. Research design

In this section of the thesis the data and methodology will be discussed comprehensively. First, the data will be discussed, specifically where the data were acquired from and how the data were cleaned to prepare them for their intended use. Next the methodology will be discussed. This includes defining all variables and describing the statistical methods and techniques used to draw conclusions for this thesis.

3.1. Data

The databases used for this thesis include Compustat, specifically Compustat North America, and ExecuComp. The North America section of Compustat contains data on financial statement items and related items for North American companies. From Compustat, I extract a variety of data, such as data on investments, on assets, and on sales. North America is chosen as the research region for Compustat, because of the data availability of Compustat and because the other database, Execucomp, contains only North American data. In contrast to Compustat, which contains only firm-level data, ExecuComp contains data on company executives. Most importantly, these data include whether executives are CEOs of their firms and also the start dates and end dates of their tenures. Additionally, the database contains data on CEO characteristics, such as age, gender and company stock holdings. I merge these two databases to create a comprehensive dataset. Following this merger, I perform a few adjustments in accordance with Biddle et al. (2009) to arrive at the final dataset. First, I exclude firms in the financial services industry (i.e., sic codes between 6000 and 6999) as these firms are not comparable to other firms in different industries. This is because of the different nature of investments for these firms. Second, I delete observations from industry-years (based on the Fama-French 48-industry classification) that contain less than twenty observations in total. This is to ensure that the statistical models have enough observations to make valid investment predictions. Third, all continuous variables are Winsorized at the 1% and 99% level by year at the firm-year level to reduce the influence of outliers. Taking these manipulations into account, I arrive at a final dataset containing 17,038 observations total on 3,545 CEOs, from 1,942 firms, covering the period from 1992 to 2021.

3.2. Methodology

Based on Biddle et al. (2009), the method used to examine the relationship between CEO tenure and investment efficiency comprises two steps: (1) predicting the expected level of investment (2) modelling the relationship between overinvestment/underinvestment and CEO tenure using a multinomial logit regression.

In the first step a linear regression equation is used to predict the expected level of investment. As discussed before, this model is only estimated for industry-years (in accordance with the Fama-French 48-industry classification) that consists of at least twenty observations. The regression equation is as follows:

$$Investment_{i,t+1} = \beta_0 + \beta_1 * Sales\ Growth_{i,t} + \varepsilon_{i,t+1}$$

Where:

1. Investment = The sum of research and development expenditure, capital expenditure and acquisition expenditure minus the cash receipts from the sale of property, plant and equipment, multiplied by 100 and scaled by lagged total assets.[4]
2. Sales Growth = The percentage change in net sales from year t-1 to year t.

Deviations from the optimal level of investment (i.e., the error $\varepsilon_{i,t+1}$) are then sorted into classes based on the magnitude of the deviations. More specifically, the deviations are sorted into quartiles for each firm-year. The most negative deviations (the bottom quartile) are classified as underinvestment and the most positive deviations (the top quartile) are classified as overinvestment. The middle two quartiles are classified as the benchmark group. This approach is used because demand is only weakly related to the optimal investment amount. Classifying only the extreme quartiles as suboptimal investments mitigates this problem to some extent (Gao & Yu, 2020). Nevertheless, to validate the results robustness tests will be performed whereby other predictors of investment are considered (e.g., Tobin's Q).

The second step consists of modelling directly the probability that a firm will be in the overinvestment group or in the underinvestment group as opposed to being in the benchmark group, based on a CEO being in the early years of their tenure or in the final year of their tenure. For this, a lagged multinomial logit model is used. The model is lagged, because firms generally prepare investment budgets a fiscal year in advance (Gan, 2019). The model is as follows:[5]

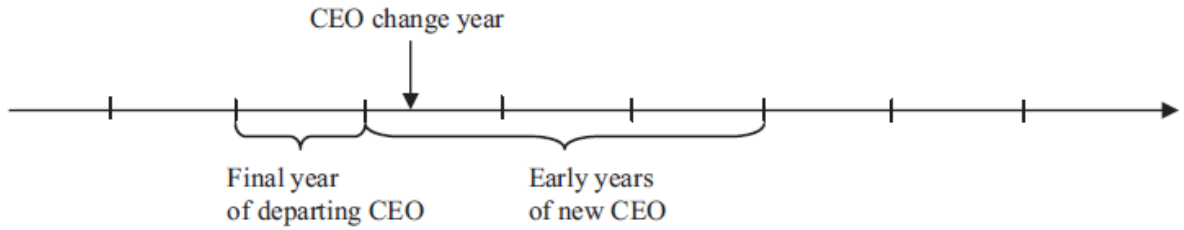
$$\begin{aligned}\ln\left(\frac{Overinvestment_{i,t+1}}{Efficient\ Investment_{t+1}}\right) = {} & \beta_0 + \beta_1 Early\ Years_{i,t} + \beta_2 CEO\ Ownership_{i,t} + \beta_3 CEO\ age_{i,t} \\ & + \beta_4 CEO\ Gender_{i,t} + \beta_5 Size_{i,t} + \beta_6 MTOB_{i,t} + \beta_7 Loss_{i,t} \\ & + \beta_8 Sales\ Volatility_{i,t} + \beta_9 Investment\ Volatility_{i,t} + \beta_{10} CFO\_Sales_{i,t} \\ & + \beta_{11} CFO\ Volatility_{i,t} + \beta_{12} Litigation\ Risk_{i,t} + \beta_{13} Slack_{i,t} \\ & + \beta_{14} Dividends_{i,t} + \beta_{15} Z\text{-}Score_{i,t} + \beta_{16} Tangibility_{i,t} + \beta_{18} K\text{-}Structure_{i,t} \\ & + \beta_{17} Industry\ K\text{-}Structure_{i,t}\end{aligned}$$

Above is the model for the first hypothesis, namely that CEOs invest inefficiently during the early years of their tenure compared to the middle years. The model for the second hypothesis, which states that CEOs invest inefficiently during the final year of their tenure compared to the middle years, is almost the same. The indicator variable of interest *Early Years*$_{i,t}$ is replaced with the indicator variable *Final Year*$_{i,t}$. At the same time *Early Years*$_{i,t}$ is added as an additional control variable to the model, because omission of this variable may bias against finding evidence of inefficient investments (Ali & Zhang, 2015).[6] With regard to the hypotheses, hypothesis one and hypothesis two predict that CEOs in the early years and final year of their tenure are less likely to be in the underinvestment group or in the

[4] This means a comprehensive measure of investment is used, in line with Biddle et al. (2009).
[5] The model is the same for underinvestment, except Overinvestment$_{i,t+1}$ is replaced by Underinvestment$_{i,t+1}$.
[6] Supposedly this solves the issue of the Early Years$_{i,t}$ variable and the Final Year$_{i,t}$ variable overlapping.

overinvestment group, as opposed to being in the benchmark group. This means statistically significant coefficient are expected for the *Early Years*$_{i,t}$ variable and the *Final Year*$_{i,t}$ variable. With regard to the variable definitions, the *Early Years*$_{i,t}$ variable corresponds to the first three fiscal years of CEO tenure, including the fiscal year of change, and the *Final Year*$_{i,t}$ variable corresponds to the fiscal year before the CEO leaves office. These definitions are in line with research by Gabarro (1987) that state that the first phase of CEO tenure lasts between two-and-a-half and three years, and Ali and Zhang (2015) that use the same cut-off points for their research on CEO tenure and earnings management. See figure 1 for clarification.

Figure 1
Timeline for defining the early years variable and the final year variable (adapted from Ali & Zhang, 2015).



Multiple controls are then added to the model to ensure the validity of the results. These controls and the related definitions and rationales are discussed in order.

The first three control variables are: (1) *CEO Ownership*$_{i,t}$, (2) *CEO Age*$_{i,t}$ and (3) *CEO Gender*$_{i,t}$. These variables are CEO characteristics. *CEO Ownership*$_{i,t}$, refers to the percentage of the total shares of the company that a CEO owns. Ghosh et al. (2007) argue that overinvestment and underinvestment agency problems are connected with ownership structure. They find an inverted u-shaped relationship between CEO ownership and research and development expenditures, but they find no relationship between CEO ownership and capital expenditures. As this thesis uses a comprehensive measure of investment, CEO ownership is included as a control variable. *CEO Age*$_{i,t}$ is the age of the CEO in years. Yim (2013) finds that young CEOs have a higher probability of engaging in acquisitions. *CEO Gender*$_{i,t}$. is a dummy variable that is one if the CEO is female, and zero if the CEO is male. Zeng and Wang (2015) find that female CEOs are more conservative than their male counterparts with regard to investments. Given these findings, *CEO Age*$_{i,t}$ and *CEO Gender*$_{i,t}$. are also added as control variables.

CFO Volatility$_{i,t}$, *CFO_Sales*$_{i,t}$ and *Slack*$_{i,t}$ are included to control for cash levels. *CFO Volatility*$_{i,t}$ refers to the standard deviation of cash flows from operations deflated by the average total assets from year t-5 to t-1.[7] *CFO_Sales*$_{i,t}$ is the cash flows from operations divided by the net sales. *Slack*$_{i,t}$ is cash divided by property, plant and equipment. These

[7] I require for volatility-related variables (CFO Volatility$_{i,t}$, Investment Volatility$_{i,t}$, and Sales Volatility$_{i,t}$) at least three successive years of non-missing observations.

variables are in line with the hypothesis made by Jensen (1986) that excess internal cash-holdings may lead to overinvestment problems.

Investment Volatility$_{i,t}$ refers to the standard deviation of investments from year t-5 to t-1. It is added as a control to make sure that the results do not simply represent a relationship between overinvestment or underinvestment, and investment volatility (Biddle et al., 2009). *Litigation Risk*$_{i,t}$ is an indicator variable if a firm is in a high-litigation industry. These industries are SIC codes: 2833–2836; 3570–3577;3600–3674;5200–5961, and 7370–7374 (Ali & Zhang, 2015). *Litigation Risk*$_{i,t}$ is added, because it may mitigate agency problems and as a result may lead to more efficient capital allocation (Biddle & Hillary, 2006).

The rationales for the remaining control variables are relatively straightforward. *Sales Volatility*$_{i,t}$ and *Loss*$_{i,t}$ are used to control for firm profitability. *Sales Volatility*$_{i,t}$ is the standard deviation of sales deflated by average total assets from year t-5 to t-1. *Loss*$_{i,t}$ is an indicator variable that is one if a firm had negative net income before extraordinary items in a given year and zero otherwise. *MTOB*$_{i,t}$ and *Size*$_{i,t}$ are used to control for a firm's maturity stage and growth opportunities. *MTOB*$_{i,t}$ is the market value of a firm's total assets divided by the book value of a firm's total assets. *Size*$_{i,t}$ is the natural logarithm of a firm's total assets. *Dividends*$_{i,t}$ and the *Z-Score*$_{i,t}$ are used to control for the degree of financial constraint of a firm. *Dividends*$_{i,t}$ is an indicator variable that is one if a firm paid dividends in a given year and zero otherwise. The *Z-Score*$_{i,t}$ is from Altman (1968) and represents a score that indicates the risk of bankruptcy. This is 3.3 times the pretax income, plus the net sales, plus 0.25 times the retained earnings, plus 0.5 times the working capital divided by the total assets. *K-Structure*$_{i,t}$ and *Industry K-Structure*$_{i,t}$ control for the market leverage both of firms and of specific industries. *K-Structure*$_{i,t}$ is long-term debt divided by the sum of long-term debt and the market value of equity. *Industry K-Structure*$_{i,t}$ is the mean *K-Structure*$_{i,t}$ for firms in the same industry (SIC 3-digits). Finally, *Tangibility*$_{i,t}$ is used to control for the tangibility of a firm's asset structure. *Tangibility*$_{i,t}$ is property, plant and equipment divided by total assets. These control variables are primarily based on Gan (2019), who in turn bases them on research from Biddle (2009), Cheng et al. (2013) and Garcia Lara et al. (2006).

4. Results

In this section of the thesis, the actual empirical research will be performed. This empirical research consists of three steps. The first step is to showcase and discuss a number of descriptive statistics, with the goal of obtaining an initial understanding of the data. The second step consists of performing the discussed multinomial logit regression, interpreting the regression coefficients, and accepting or rejecting the hypotheses based on the findings. Finally, the third step is to perform a battery of robustness checks to validate the results of the main model.

4.1. Descriptive statistics

In this section various descriptive statistics will be provided. These descriptive statistics allow for an initial insight into the data before the main analysis is performed.

Table 1

Descriptive statistics

Variable	Mean	Std	Min	Median	Max
Investment (%)	11.18	10.98	0.22	7.86	92.42
Deviations (ε)	0.00	9.33	-64.60	1.52	35.27
Early Years	0.25	0.43	0.00	0.00	1.00
Final Year	0.12	0.32	0.00	0.00	1.00
CEO Ownership	2.65	6.10	0.00	0.47	48.21
CEO Age	56.01	7.17	35.00	56.00	79.28
CEO Gender	0.04	0.20	0.00	0.00	1.00
Size	7.34	1.73	2.98	7.18	12.38
MTOB	2.22	1.66	0.58	1.69	30.42
Loss	0.20	0.40	0.00	0.00	1.00
Sales Volatility	0.23	0.23	0.01	0.16	2.84
Investment Volatility	5.76	9.15	0.13	2.80	149.45
CFO_Sales	0.11	0.27	-5.69	0.11	0.67
CFO Volatility	0.06	0.05	0.00	0.04	0.36
Litigation Risk	0.43	0.50	0.00	0.00	1.00
Slack	2.88	7.62	0.00	0.63	83.64
Dividends	0.48	0.50	0.00	0.00	1.00
Z-Score	1.38	1.11	-6.92	1.30	5.70
Tangibility	0.27	0.24	0.01	0.18	0.92
K-Structure	0.17	0.19	0.00	0.12	0.89
Industry K-Structure	0.17	0.10	0.04	0.13	0.54

Note: The dataset contains 17,038 observations. The Deviations (ε) are the residuals of model one from the research design section. Positive deviations indicate overinvestment and negative deviations indicate underinvestment. See Appendix 1 for the other variable descriptions.

Table 1 contains descriptive statistics of the data. These descriptive statistics include for each individual variable the mean, the standard deviation, the minimum value, the median value and the maximum value. The descriptive statistics of the first four variables are the most important ones, as essentially they correspond to the dependent and independent variables of this thesis. The mean of the *Investment* variable is 11.18. This implies that on average firm investments are about 11% of prior year's assets. The minimum and maximum values of the

Deviations (ε) variable are -64.60 and 35.27 respectively.[8] This means that at minimum the predicted investments are about 65% of prior year's assets lower than the actual investments and at maximum about 35% of prior year's assets higher than the actual investments. The average of the *Early Years* variable is 0.25. This implies that about 25% of the total observations in the dataset correspond to the first three fiscal years of CEO tenure. For the *Final Year* variable this number is 12% of the observations. The values of these variables are similar to prior research (e.g., Gan, 2019).

Table 2
Correlation matrix

Variable	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.	14.	15.	16.	17.	18.	19.	20.	21.
1. Investment	**1**																				
2. Deviations (ε)	-0.85*	**1**																			
3. Early Years	-0.05*	0.02*	**1**																		
4. Final Year	-0.05*	0.03*	-0.02*	**1**																	
5. CEO Ownership	0.03*	-0.01	-0.17*	-0.05*	**1**																
6. CEO Age	-0.09*	0.08*	-0.22*	0.11*	0.11*	**1**															
7. CEO Gender	-0.03*	0.00	0.06*	-0.01*	-0.04*	-0.04*	**1**														
8. Size	-0.25*	0.16*	0.05*	0.03*	-0.21*	0.13*	0.02*	**1**													
9. MTOB	0.31*	-0.23*	-0.07*	-0.05*	0.05*	-0.05*	0.01	-0.18*	**1**												
10. Loss	0.13*	-0.10*	0.09*	0.06*	-0.02*	-0.07*	0.00	-0.21*	-0.10*	**1**											
11. Sales Volatility	0.02*	0.01	-0.05*	0.00	0.14*	-0.10*	0.00	-0.27*	0.13*	-0.01	**1**										
12. Investment Volatility	0.31*	-0.18*	-0.04*	-0.02*	0.04*	-0.12*	-0.02*	-0.17*	0.12*	0.15*	0.15*	**1**									
13. CFO_Sales	-0.15*	0.13*	-0.03*	-0.02*	-0.02*	0.04*	0.01	0.28*	-0.02*	-0.30*	-0.09*	-0.11*	**1**								
14. CFO Volatility	0.33*	-0.21*	-0.04*	-0.02*	0.10*	-0.13*	-0.01	-0.43*	0.31*	0.17*	0.39*	0.3*	-0.21*	**1**							
15. Litigation Risk	0.20*	-0.08*	-0.01*	0.01	0.06*	-0.09*	0.02*	-0.22*	0.22*	0.08*	0.08*	0.11*	-0.11*	0.22*	**1**						
16. Slack	0.16*	-0.07*	-0.03*	-0.03*	0.04*	-0.06*	-0.01	-0.25*	0.18*	0.12*	0.02*	0.14*	-0.20*	0.35*	0.25*	**1**					
17. Dividends	-0.23*	0.13*	0.030*	0.00	-0.05*	0.14*	0.02*	0.41*	-0.10*	-0.23*	-0.18*	-0.20*	0.12*	-0.31*	-0.26*	-0.19*	**1**				
18. Z-Score	-0.23*	0.14*	-0.02*	-0.03*	0.11*	0.05*	0.05*	-0.03*	0.12*	-0.45*	0.40*	-0.23*	0.19*	-0.07*	-0.01	-0.20*	0.17*	**1**			
19. Tangibility	0.10*	-0.10*	0.01	0.00	-0.01	0.08*	0.03*	0.25*	-0.21*	-0.03*	-0.11*	0.03*	0.20*	-0.15*	-0.24*	-0.32*	0.21*	-0.06*	**1**		
20 .K-Structure	-0.23*	0.14*	0.08*	0.06*	-0.12*	0.05*	0.00	0.36*	-0.41*	0.18*	-0.15*	-0.02*	0.04*	-0.26*	-0.25*	-0.20*	0.11*	-0.23*	0.36*	**1**	
21. Industry K-Structure	-0.12*	0.02*	0.04*	0.01	-0.10*	0.09*	0.00	0.38*	-0.31*	-0.05*	-0.12*	-0.05*	0.13*	-0.22*	-0.44*	-0.24*	0.26*	-0.08*	0.57*	0.56*	**1**

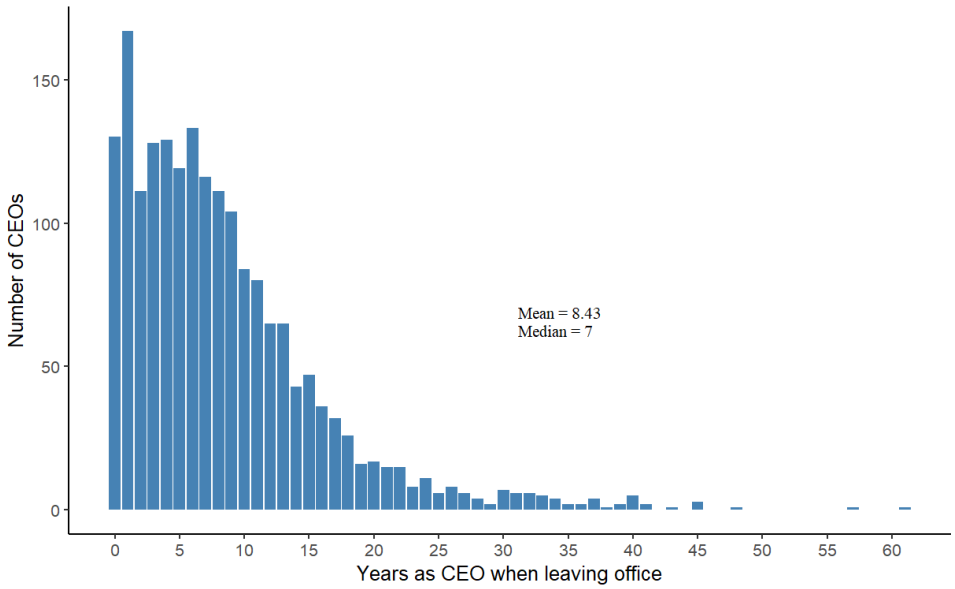
Note: * indicates a p-value below 0.1. See Appendix 1 for variable descriptions.

Table 2 contains a correlation matrix. The most important correlations are those of *Investment* and *Deviations (ε)* with *Early Years* and with *Final Year*. The correlation between *Investment* and *Early Years* is -0.05. This is in line with prior research by Pan et al. (2016) and Gan (2019), who find that investment levels are negatively related to the early years of CEO tenure. However, the correlation between *Deviations (ε)* and *Early Years* is 0.02. This implies that, even though the level of investment is lower in the early years of CEO tenure, CEOs may potentially overinvest relative to the optimal level of investment, as determined by the sales growth. With regard to the final years, the correlation between *Investment* and *Final Year* is also -0.05. This contradicts Pan et al. (2016) who find a positive relationship between CEO tenure and investment levels. Nevertheless, the correlation between *Deviations (ε)* and *Final Years* is 0.03. This coincides with the explanation by Pan et al. (2016) that as CEO tenure increases the quality of investments potentially drops and CEOs may tend to overinvest, regardless of whether the actual level of investment increases. Of course, these findings simply represent one-to-one relationships. To draw conclusions, it is necessary to control for various factors.

[8] The mean of 0 for Deviations (ε) is a characteristic of linear regression models. Therefore, 0 does not imply that the predictions are right on average.

Lastly, Figure 2 contains a frequency distribution showing the number of years before CEOs leave office. This plot is based on only the CEOs who leave office during the sample period 1992-2021. The mean and median number of years before CEOs leave office are about 8.4 years and 7 years respectively. These numbers are relatively similar to Ali and Zhang (2015) who find an average number of 8.1 years and a median number of 6 years before CEOs leave office. As noted previously, three years is used as a cut-off point for the *Early Years* variable. These early years represent about 36% of the length of an average CEO's tenure.

Figure 2
Frequency distribution showing the number years before CEOs leave office.



4.2. Results

The regression results of multinomial logit model are reported in Table 3. The results used to draw conclusions for hypothesis 1 are reported in columns 1 and 2, while the results used to draw conclusions for hypothesis 2 are reported in columns 3 and 4. The reference category for this table is the benchmark group (i.e., the middle two residual quartiles). The coefficients have been exponentiated for ease of interpretation. This means that the coefficients indicate the likelihood of being in the overinvestment or underinvestment group relative to being in the benchmark group.

Table 3

CEO tenure and deviations from the expected level of investment.

	H1: Early Years		H2: Final Year	
	(1)	(2)	(3)	(4)
Variable	Underinvestment	Overinvestment	Underinvestment	Overinvestment
Early Years	0.921	0.978	0.921	0.978
	(0.057)	(0.060)	(0.057)	(0.060)
Final Year			0.965	0.961
			(0.064)	(0.059)
CEO Ownership	0.994	1.004	0.994	1.004
	(0.006)	(0.007)	(0.006)	(0.007)
CEO Age	0.990*	1.014**	0.991*	1.014*
	0.005)	(0.006)	(0.005)	(0.006)
CEO Gender	0.912	0.888	0.911	0.888
	(0.153)	(0.167)	(0.153)	(0.167)
Size	0.932*	1.024	0.932**	1.024
	(0.028)	(0.037)	(0.028)	(0.037)
MTOB	1.222***	0.914**	1.222***	0.914**
	(0.026)	(0.033)	(0.026)	(0.033)
Loss	1.140*	0.862*	1.142*	0.863*
	(0.088)	(0.072)	(0.088)	(0.072)
Sales Volatility	0.717*	2.368***	0.718*	2.371***
	(0.122)	(0.426)	(0.123)	(0.427)
Investment Volatility	1.015***	1.002	1.015***	1.002
	(0.004)	(0.004)	(0.004)	(0.004)
CFO_Sales	1.102	1.876***	1.101	1.874***
	(0.126)	(0.331)	(0.126)	(0.330)
CFO Volatility	40.915***	2.776	40.998***	2.783
	(33.059)	(2.542)	(33.119)	(2.548)
Litigation Risk	1.096	0.874	1.097	0.875
	(0.101)	(0.091)	(0.101)	(0.091)
Slack	1.001	1.004	1.001	1.004
	(0.005)	(0.006)	(0.005)	(0.006)
Dividend	0.690***	1.162	0.690***	1.162
	(0.057)	(0.106)	(0.057)	(0.106)
Z-Score	0.771***	0.773***	0.771***	0.773***
	(0.031)	(0.043)	(0.031)	(0.043)
Tangibility	5.949***	0.142***	5.945***	0.141***
	(1.278)	(0.038)	(1.278)	(0.038)
K-Structure	0.087***	2.814***	0.087***	2.822***
	(0.023)	(0.686)	(0.023)	(0.688)
Industry K-Structure	0.361*	0.029***	0.361*	0.029***
	(0.213)	(0.018)	(0.212)	(0.018)
Constant	1.153	0.555	1.145	0.551
	(0.416)	(0.225)	(0.415)	(0.224)
Firm Cluster	Yes	Yes	Yes	Yes
Obs	17,038	17,038	17,038	17,038
Pseudo R^2 (%)	9.94	9.94	9.94	9.94

Note: This table presents the exponentiated results from logistic multinomial pooled regressions. The dependent variable is a categorical variable based on the level of unexplained investment. Deviations in the bottom quartile are classified as 'underinvestment' (coded as 1) and deviations in the top quartile are classified as 'overinvestment' (coded as 3). The middle two quartiles are classified as the benchmark group (coded as 2). The first two columns show the results for the first hypothesis, and the last two columns show the results for the second hypothesis. See Appendix 1 for the variable descriptions. The standard errors are shown in parentheses below the regression coefficients and are corrected for heteroscedasticity. Additionally, observations are clustered by firm. ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively.

The first hypothesis states that CEOs invest inefficiently during the early years of their tenure compared to the middle years of their tenure. For this thesis, the early years are measured as the first three fiscal years a CEO is in office. The relevant coefficients to accept or reject this hypothesis are those of the *Early Years* variable reported in column 1 and in column 2 of Table 3. In column 1 the coefficient is 0.921 and in column 2 the coefficient is 0.978. This means that, keeping all other variables constant, if CEOs are in the early years of their tenure, a CEO is 0.921 (0.978) times more likely to be classified as underinvesting (overinvesting) compared to investing efficiently. However, both coefficients are statistically insignificant. This leads to the conclusion that CEOs in the early years of their tenure do not invest inefficiently compared to the middle years of their tenure. Therefore, the first hypothesis is rejected.[9] Nevertheless, from CEO tenure literature various reasons are derived as to why CEOs may invest more inefficiently during the early years of their tenure. At first glance, the results are therefore not as expected. Taking these factors into account, there are two possibilities: (1) the model is incorrect or (2) the model is correct and CEOs are not more likely to invest inefficiently during their early years. The first possibility will be examined by performing a number of robustness checks in the next section. The second possibility implies that the results are correct and that CEOs are indeed not more likely to invest inefficiently during the early years of their tenure. This is definitely a possibility, as there is limited research indicating otherwise (e.g., Gan, 2019). Additionally, various potential explanations for these results can be pointed out. For example, supervision by internal or external parties. Shen (2003) notes that CEOs may not be able to invest inefficiently due to strict monitoring by the board of directors early on in their tenure and due to lacking power. Another potential reason is that CEOs do not use investments to achieve their private goals, but that instead they use other tools. For example, earnings management. Ali & Zhang (2015) find that CEOs manipulate earnings early on in their tenure. In any case, more research will be needed to approve or disprove these findings.

The second hypothesis states that CEOs invest inefficiently during the final year of their tenure compared to the middle years of their tenure. The final year is measured as the fiscal year before a CEO leaves office. The relevant coefficients to accept or reject this hypothesis are those of the *Final Year* variable reported in columns 3 and 4 of Table 3. The coefficient in column 3 is 0.965 and the coefficient in column 4 is 0.961. This means that, keeping all other variables constant, if CEOs are in the final year of their tenure, a CEO is 0.965 (0.961) times more likely to be classified as underinvesting (overinvesting) compared to investing efficiently. However, these coefficients are statistically insignificant. Therefore, the second hypothesis is also rejected. The same possibilities arise as with the first hypothesis: (1) the model is incorrect or (2) the model is correct and CEOs are not more likely to invest inefficiently in the final year. The first possibility will be examined by performing a number of robustness checks. With regard to the second possibility, the results may be correct. However, empirical research on the final years of CEO tenure and investment efficiency is

[9] Untabulated results indicate that the outcome remains unchanged even if the *Early Years* variable is replaced by individual year variables.

severely lacking.[10] Nevertheless, various theoretical arguments can be pointed out. For example, Brickley, Linck and Coles (1999) find that firm performance as CEO is positively and strongly related to the likelihood of him or her being appointed as a board member to both the CEO's own board as well as to outside boards. This means a CEO's own career concerns may prevent opportunistic behaviour. Additionally, the horizon problem of CEOs acting opportunistically near the end of their tenure may also be mitigated by designing appropriate compensation contracts (Edmans et al., 2012). In any case, more research is needed to support or disprove these findings.

4.3. Robustness checks

To validate the results of the main model, two robustness checks will be performed. These are (1) controlling for CEO ability and (2) using different variables to estimate *Investment*.[11] The first robustness check is used to determine if high-ability CEOs engage in inefficient investments. On the one hand high ability CEOs have more human capital, potentially leading to more efficient investments (e.g., Chang et al., 2010). On the other hand, they may have more power, potentially leading to inefficient investments (Kor, 2006; Shen, 2003). The second robustness check is used to determine whether *Sales Growth* is a meaningful predictor of firm investments.

CEO ability

The first robustness check is to control for CEO ability. Habib & Hasan (2017) find that managerial ability matters for investment. Specifically, they find that high-ability CEOs overinvest relative to their lower-ability counterparts. Logically, if these lower-ability CEOs get dismissed quickly, and if they represent a substantial portion of the sample, the results might be biased towards finding no investment inefficiency. In support of this, Dikolli et al. (2014) find that the probability of a performance-related dismissal is higher during the early years of a CEO's tenure. To proxy for CEO ability, the main analysis is reperformed for CEOs who stay in office for a relatively long period of time. Milbourn (2003) finds that CEOs with a long stay in office are likely to be more talented. In line with Ali & Zhang (2015), the median number of years before a CEO leaves office is used as the cut-off point, which is 7 years (see Figure 2). This criterion results in a decrease of the sample size from 17,038 observations to 9,493 observations. The results are reported in Table 4 in Appendix 2. The coefficients for the first hypothesis (*Early Years*) are reported in columns 1 and 2. These coefficients are 0.857 for underinvestment and 1.002 for overinvestment. The coefficients for the second hypothesis (*Final Year*) are reported in columns 3 and 4. These coefficients are 0.961 for underinvestment and 0.898 for overinvestment. However, none of these coefficients are statistically significant. This supports the findings of the main model. CEO investment inefficiency does not seem to be concentrated in high-ability CEOs. Nevertheless, there are still some caveats. For example, CEO tenure is not a perfect proxy for CEO ability. At some

[10] To my knowledge there are no studies that examine the final year of CEO tenure and investment efficiency.
[11] In contrast to Biddle et al. (2009), in this thesis it is not possible to subdivide *Investment* as a robustness test. This is due to data constraints. It may be possible that CEOs invest inefficiently in some investment categories but not in others. Future research should consider this possibility.

point CEOs can potentially entrench themselves and keep their position, regardless of their ability (Shen, 2003). More research should be performed to validate these results.

Using other predictors of investment

The next robustness check is to use other predictors of *Investment* than *Sales Growth*. As Gao and Yu (2020) note, models that use output growth as a predictor of investment usually have low explanatory power. This is because output growth only weakly relates to investments. To somewhat counteract this problem only the most extreme deviations (the top and bottom quartiles) are classified as inefficient investments (Biddle et al., 2009). However, the above problem remains even after this procedure (Gao & Yu, 2020). Therefore, two additional models will be used to predict investment. The first model uses the lagged Tobin's Q as an explanatory variable, and the second model uses both the lagged Tobin's Q and sales growth as explanatory variables (Verdi, 2006). The results for the first model are in Table 5 of Appendix 3 and the results for the second model are in Table 6 of Appendix 3. Interestingly, the coefficients in Table 5 of *Early Years* (column 1: 0.939) and of *Final Year* (column 3: 0.893) are statistically significant. This contradicts the previous results and would imply that CEOs are more likely to underinvest in their early years and in their final year compared to their middle years. However, the coefficients in Table 6 are statistically insignificant. This implies that the statistical significance of the Tobin's Q model is likely due to chance, as Tobin's Q is only a rough estimate of the marginal Q ratio traditionally used in Neoclassic theory to determine investment (Biddle et al., 2009; Hayashi, 1982). Overall, the findings of this robustness check support the results of the main model. CEOs do not seem to invest inefficiently during the early years and during the final year of their tenure compared to the middle year of their tenure. Nevertheless, caveats remain. The marginal Q only explains corporate investment when capital markets are perfect. This does not seem to be the case in reality (Hubbard, 1998). Additionally, the models assume that firms can fully replace their capital in one single period. However, in reality, capital investment takes substantial time and planning. This also undermines the power of the models (Gao & Yu, 2020). The consequence is that more research should be performed to validate the above results, especially using more intricate predictive models.

5. Conclusion

This thesis examines the relationship between CEO tenure and investment efficiency. According to literature, CEOs are responsible for investments, and they have varying level of discretion and oversight during their tenure. Therefore, according to Hambrick and Fukutomi (1991), a CEO's tenure can be split into five distinct phases. Especially interesting are the first phase and the last phase of a CEO's tenure. In this first phase, CEOs adapt to their new position and gradually learn by doing. In the last phase, CEOs become disinterested in their job in such a way that change becomes too difficult to execute. Additionally, various authors find inverted u-curve relationships between firm value and CEO tenure. Investments are said to determine firm value at least partially. These findings indicate that there may be inefficient investment in the early years and the final year of a CEO's tenure. This leads to the following main research question: *Do CEOs invest efficiently at both the beginning and the end of their tenure compared to the middle years of their tenure?* This research question is then split up into two hypotheses, corresponding to both the beginning and the end of a CEO's tenure. These hypotheses state that CEOs invest inefficiently in the early years and the final year of their tenure compared to the middle years of their tenure.

This study does not find any statistically significant results. This means that both hypotheses are rejected. CEOs do not invest inefficiently in the early years or the final year of their tenure, compared to the middle years of their tenure. These results do not change even when robustness checks are performed. Now that both hypotheses have been rejected, it is also possible to answer the main research question. The answer to the main research question is affirmative. Given the findings, CEOs do indeed invest efficiently at both the beginning and end of their tenure compared to the middle years of their tenure.

This thesis also has several limitations. First, a relatively complex model is used to answer the hypotheses. First estimating a linear regression model and then using the predicted output for the main model, is an additional step where valuable information may be lost. The results might have been different if a more direct model would have been used. It is therefore recommended for future researchers to use a model different from the one in this thesis, if possible. Second, the linear model used to predict the level of investment has too little explanatory power. This will cause the classification as 'overinvestment', 'efficient investment' and 'underinvestment' to be relatively inaccurate, potentially impacting the results. Future researchers should use more elaborate and empirically proven models to predict investments. Third, an imperfect proxy for CEO ability was used. At some point in a CEO's tenure the link between ability and tenure becomes relatively weak because of the entrenchment of the CEO. A potential different method to proxy for ability is to use proxies that capture the reason why a CEO left office, for example due to retirement or due to failure by the CEO to function properly. Future researchers should take this into account. Fourth and final, there is always the risk of having omitted variables. For example, additional proxies for external monitoring could have been used.

Literature

Adams, R. B., & Ferreira, D. (2007). A theory of friendly boards. *The journal of finance*, *62*(1), 217-250.

Ali, A., & Zhang, W. (2015). CEO tenure and earnings management. *Journal of accounting and economics*, *59*(1), 60-79.

Allen, M. P., & Panian, S. K. (1982). Power, performance, and succession in the large corporation. *Administrative Science Quarterly*, 538-547.

Altman, E. I. (1968). Financial ratios, discriminant analysis and the prediction of corporate bankruptcy. *The journal of finance*, *23*(4), 589-609.

Barker III, V. L., & Mueller, G. C. (2002). CEO characteristics and firm R&D spending. *Management science*, *48*(6), 782-801.

Benlemlih, M., & Bitar, M. (2018). Corporate social responsibility and investment efficiency. *Journal of business ethics*, *148*, 647-671.

Biddle, G. C., & Hilary, G. (2006). Accounting quality and firm-level capital investment. *The accounting review*, *81*(5), 963-982.

Biddle, G. C., Hilary, G., & Verdi, R. S. (2009). How does financial reporting quality relate to investment efficiency?. *Journal of accounting and economics*, *48*(2-3), 112-131.

Boeker, W. (1992). Power and managerial dismissal: Scapegoating at the top. *Administrative science quarterly*, 400-421.

Boeker, W. (1997). Strategic change: The influence of managerial characteristics and organizational growth. *Academy of management journal*, *40*(1), 152-170.

Brickley, J. A., Linck, J. S., & Coles, J. L. (1999). What happens to CEOs after they retire? New evidence on career concerns, horizon problems, and CEO incentives. *Journal of Financial Economics*, *52*(3), 341-377.

Brochet, F., Limbach, P., Schmid, M., & Scholz-Daneshgari, M. (2021). CEO tenure and firm value. *The Accounting Review*, *96*(6), 47-71.

Chang, Y. Y., Dasgupta, S., & Hilary, G. (2010). CEO ability, pay, and firm performance. *Management Science*, *56*(10), 1633-1652.

Chen, D., & Zheng, Y. (2014). CEO tenure and risk-taking. *Global Business and Finance Review*, *19*(1), p1-27.

Chen, R., El Ghoul, S., Guedhami, O., & Wang, H. (2017). Do state and foreign ownership affect investment efficiency? Evidence from privatizations. *Journal of Corporate Finance*, *42*, 408-421.

Cheng, M., Dhaliwal, D., & Zhang, Y. (2013). Does investment efficiency improve after the disclosure of material weaknesses in internal control over financial reporting?. *Journal of accounting and economics*, *56*(1), 1-18.

Cirillo, A., Pennacchio, L., Carillo, M. R., & Romano, M. (2021). The antecedents of entrepreneurial risk-taking in private family firms: CEO seasons and contingency factors. *Small Business Economics*, *56*, 1571-1590.

Darouichi, A., Kunisch, S., Menz, M., & Cannella Jr, A. A. (2021). CEO tenure: An integrative review and pathways for future research. *Corporate Governance: An International Review*, *29*(6), 661-683.

Dikolli, S. S., Mayew, W. J., & Nanda, D. (2014). CEO tenure and the performance-turnover relation. *Review of accounting studies*, *19*, 281-327.

Dixit, R. K., Dixit, A. K., & Pindyck, R. S. (1994). *Investment Under Uncertainty*. Princeton University Press.

Du, C., & Lin, T. T. (2011). CEO turnover, equity-based compensation and firms investment decisions. *Journal of Business & Economics Research (JBER)*, *9*(8), 19-40.

Edmans, A., Gabaix, X., Sadzik, T., & Sannikov, Y. (2012). Dynamic CEO compensation. *The Journal of Finance*, *67*(5), 1603-1647.

Gabarro, J. J. (1987). *The dynamics of taking charge*. Harvard Business Press.

Gan, H. (2019). How do CEOs make investment decisions in their early years of tenure? Evidence from investment efficiency. *Journal of Corporate Accounting & Finance*.

Gao, R., & Yu, X. (2020). How to measure capital investment efficiency: A literature synthesis. *Accounting & Finance*, *60*(1), 299-334.

Ghosh, A., Moon, D., & Tandon, K. (2007). CEO ownership and discretionary investments. *Journal of Business Finance & Accounting*, *34*(5-6), 819-839.

Graf-Vlachy, L., Bundy, J., & Hambrick, D. C. (2020). Effects of an advancing tenure on CEO cognitive complexity. *Organization Science*, *31*(4), 936-959.

Habib, A., & Hasan, M. M. (2017). Managerial ability, investment efficiency and stock price crash risk. *Research in International Business and finance*, *42*, 262-274.

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

Hambrick, D. C., & Mason, P. A. (1984). Upper echelons: The organization as a reflection of its top managers. *Academy of management review*, *9*(2), 193-206.

Hayashi, F. (1982). Tobin's marginal q and average q: A neoclassical interpretation. *Econometrica: Journal of the Econometric Society*, 213-224.

Henderson, A. D., Miller, D., & Hambrick, D. C. (2006). How quickly do CEOs become obsolete? Industry dynamism, CEO tenure, and company performance. *Strategic Management Journal*, *27*(5), 447-460.

Hill, C. W., & Phan, P. (1991). CEO tenure as a determinant of CEO pay. *Academy of Management journal*, *34*(3), 707-717.

Hubbard, R. G. (1998). Capital-Market Imperfections and Investment. *Journal of Economic Literature*, *36*(1), 193–225.

Islam, E., & Zein, J. (2020). Inventor CEOs. *Journal of Financial Economics*, *135*(2), 505-527.

Jensen, M. C., & Meckling, W. H. (1976). Theory of the firm: Managerial behavior, agency costs and ownership structure. *Journal of financial economics*, *3*(4), 305-360.

Kalyta, P. (2009). Accounting discretion, horizon problem, and CEO retirement benefits. *The Accounting Review*, *84*(5), 1553-1573.

Kor, Y. Y. (2006). Direct and interaction effects of top management team and board compositions on R&D investment strategy. *Strategic management journal*, *27*(11), 1081-1099.

Kothari, S. P., Ramanna, K., & Skinner, D. J. (2010). Implications for GAAP from an analysis of positive research in accounting. *Journal of Accounting and Economics*, *50*(2-3), 246-286.

Lara, J. M. G., Osma, B. G., & Penalva, F. (2016). Accounting conservatism and firm investment efficiency. *Journal of Accounting and Economics*, *61*(1), 221-238.
Yim, S. (2013). The acquisitiveness of youth: CEO age and acquisition behavior. *Journal of financial economics*, *108*(1), 250-273.

Luo, X., Kanuri, V. K., & Andrews, M. (2014). How does CEO tenure matter? The mediating role of firm-employee and firm-customer relationships. *Strategic Management Journal*, *35*(4), 492-511.

Milbourn, T. T. (2003). CEO reputation and stock-based compensation. *Journal of Financial Economics*, *68*(2), 233-262.

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

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.

Myers, S. C., & Majluf, N. S. (1984). Corporate financing and investment decisions when firms have information that investors do not have. *Journal of financial economics*, *13*(2), 187-221.

Naaman, C., & Sun, L. (2022). CEO power and R&D investment. *Accounting Research Journal*, *35*(2), 160-177.

Nguyen, P., Rahman, N., & Zhao, R. (2018). CEO characteristics and firm valuation: a quantile regression analysis. *Journal of Management & Governance*, *22*, 133-151.

O'brien, J. P. (2003). The capital structure implications of pursuing a strategy of innovation. *Strategic Management Journal*, *24*(5), 415-431.

Ocasio, W. (1994). Political dynamics and the circulation of power: CEO succession in US industrial corporations, 1960-1990. *Administrative science quarterly*, 285-312.

Pan, Y., Wang, T. Y., & Weisbach, M. S. (2016). CEO investment cycles. *The Review of Financial Studies*, *29*(11), 2955-2999

Quigley, T. J., & Hambrick, D. C. (2015). Has the “CEO effect” increased in recent decades? A new explanation for the great rise in America's attention to corporate leaders. *Strategic Management Journal*, *36*(6), 821-830.

Shen, W. (2003). The dynamics of the CEO-board relationship: An evolutionary perspective. *Academy of Management Review*, *28*(3), 466-476.

Song, F., & Thakor, A. V. (2006). Information control, career concerns, and corporate governance. *The Journal of Finance*, *61*(4), 1845-1896.

Strebulaev, I. A., & Yang, B. (2013). The mystery of zero-leverage firms. *Journal of Financial Economics*, *109*(1), 1-23.

Verdi, R. S. (2006). Financial reporting quality and investment efficiency. *Available at SSRN 930922*.

Wen, Y., Rwegasira, K., & Bilderbeek, J. (2002). Corporate governance and capital structure decisions of the Chinese listed firms. *Corporate Governance: An International Review*, *10*(2), 75-83.

Weisbach, M. S. (1995). CEO turnover and the firm's investment decisions. *Journal of Financial Economics*, *37*(2), 159-188.

Zhang, Y. (2008). Information asymmetry and the dismissal of newly appointed CEOs: An empirical investigation. *Strategic Management Journal*, *29*(8), 859-872.

Zeng, S., & Wang, L. (2015). CEO gender and corporate cash holdings. Are female CEOs more conservative?. *Asia-Pacific Journal of Accounting & Economics*, *22*(4), 449-474.

Appendices

Appendix 1

Variable	Definition
Investment	The sum of research and development expenditure, capital expenditure and acquisition expenditure minus the cash receipts from the sale of property, plant and equipment, multiplied by 100 and scaled by lagged total assets.
Deviations (ε)	The Deviations (ε) are the residuals of model one (i.e., the difference between actual investment and expected investment) from the research design section. Positive deviations indicate overinvestment and negative deviations indicate underinvestment.
Sales Growth	The percentage change in net sales from year t-1 to year t.
Early Years	The first three fiscal years a CEO is in office.
Final Year	The fiscal year before a CEO leaves office.
CEO Ownership	The percentage of the total shares of the company that a CEO owns.
CEO Age	The age of the CEO in years.
CEO Gender	A dummy variable that is one if the CEO is female, and zero if the CEO is male.
Size	The natural logarithm of a firm's total assets.
MTOB	The market value of a firm's total assets divided by the book value of a firm's total assets.
Loss	An indicator variable that is one if a firm had negative net income before extraordinary items in a given year and zero otherwise.
Sales Volatility	The standard deviation of sales deflated by average total assets from year t-5 to t-1.
Investment Volatility	The standard deviation of investments from year t-5 to t-1.
CFO_Sales	Cash flows from operations divided by the net sales.
CFO Volatility	The standard deviation of cash flows from operations deflated by the average total assets from year t-5 to t-1.
Litigation Risk	An indicator variable if a firm is in a high-litigation industry.
Slack	Cash divided by property, plant and equipment.
Dividends	An indicator variable that is one if a firm paid dividends in a given year and zero otherwise.
Z-Score	3.3 times the pretax income, plus the net sales, plus 0.25 times the retained earnings, plus 0.5 times the working capital, divided by the total assets.
Tangibility	Property, plant and equipment divided by total assets.
K-Structure	Long-term debt divided by the sum of long-term debt and the market value of equity.
Industry K-Structure	The mean *K-Structure* for firms in the same industry (SIC 3-digits).

Appendix 2

Table 4

CEO tenure (min. 7 years) and deviations from the expected level of investment.

	H1: Early Years		H2: Final Year	
	(1)	(2)	(3)	(4)
Variable	Underinvestment	Overinvestment	Underinvestment	Overinvestment
Early Years	0.857	1.002	0.855	0.994
	(0.098)	(0.110)	(0.098)	(0.109)
Final Year			0.961	0.898
			(0.094)	(0.082)
CEO Ownership	1.001	1.000	1.001	1.000
	(0.006)	(0.008)	(0.006)	(0.008)
CEO Age	0.986**	1.016**	0.986**	1.017**
	(0.007)	(0.007)	(0.007)	(0.007)
CEO Gender	0.793	0.850	0.792	0.849
	(0.222)	(0.244)	(0.222)	(0.244)
Size	0.956***	1.049	0.956***	1.050
	(0.036)	(0.048)	(0.036)	(0.048)
MTOB	1.212**	0.995	1.212**	0.995
	(0.033)	(0.042)	(0.033)	(0.042)
Loss	1.242**	0.788**	1.243**	0.791**
	(0.130)	(0.090)	(0.130)	(0.090)
Sales Volatility	0.613**	2.142**	0.614**	2.149***
	(0.133)	(0.475)	(0.134)	(0.477)
Investment Volatility	1.016**	1.007	1.016**	1.007
	(0.005)	(0.005)	(0.005)	(0.005)
CFO_Sales	0.883	1.256	0.883	1.256
	(0.109)	(0.241)	(0.109)	(0.242)
CFO Volatility	45.130***	0.733	45.132***	0.732
	(45.664)	(0.899)	(45.671)	(0.898)
Litigation Risk	1.091	0.731**	1.091	0.732**
	(0.127)	(0.097)	(0.127)	(0.097)
Slack	1.002	1.005	1.002	1.005
	(0.004)	(0.005)	(0.004)	(0.005)
Dividend	0.662***	1.052	0.662	1.053
	(0.071)	(0.128)	(0.071)	(0.128)
Z-Score	0.780***	0.826***	0.780***	0.826***
	(0.044)	(0.060)	(0.044)	(0.060)
Tangibility	7.544***	0.101***	7.543***	0.101***
	(2.109)	(0.032)	(2.110)	(0.032)
K-Structure	0.086***	4.816***	0.086***	4.845***
	(0.033)	(1.732)	(0.033)	(1.746)
Industry K-Structure	0.249*	0.050***	0.249*	0.049***
	(0.201)	(0.038)	(0.200)	(0.038)
Constant	1.140	0.351**	1.129	0.343**
	(0.522)	(0.181)	(0.519)	(0.178)
Firm Cluster	Yes	Yes	Yes	Yes
Obs	9,493	9,493	9,493	9,493
Pseudo R^2 (%)	10.12	10.12	10.13	10.13

Note: This table presents the exponentiated results from logistic multinomial pooled regressions. The dependent variable is a categorical variable based on the level of unexplained investment. Deviations in the bottom quartile are classified as 'underinvestment' (coded as 1) and deviations in the top quartile are classified as 'overinvestment' (coded as 3). The middle two quartiles are classified as the benchmark group (coded as 2). The first two columns show the results for the first hypothesis, and the last two columns show the results for the second hypothesis. See Appendix 1 for the variable descriptions. The standard errors are shown in parentheses

below the regression coefficients and are corrected for heteroscedasticity. Additionally, observations are clustered by firm. ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively.

Appendix 3

Table 5

CEO tenure and deviations from the expected level of investment (Tobin's Q).

	H1: Early Years		H2: Final Year	
	(1)	(2)	(3)	(4)
Variable	Underinvestment	Overinvestment	Underinvestment	Overinvestment
Early Years	0.883**	0.939	0.882**	0.939
	(0.053)	(0.059)	(0.053)	(0.059)
Final Year			0.893*	1.006
			(0.059)	(0.060)
CEO Ownership	0.992	1.001	0.992	1.001
	(0.006)	(0.007)	(0.006)	(0.007)
CEO Age	0.992	1.016***	0.993	1.016***
	(0.005)	(0.006)	(0.005)	(0.006)
CEO Gender	0.876	0.744	0.874	0.744
	(0.142)	(0.140)	(0.141)	(0.140)
Size	0.914***	1.023	0.914***	1.023
	(0.027)	(0.036)	(0.027)	(0.036)
MTOB	1.114***	1.070***	1.114***	1.070***
	(0.024)	(0.027)	(0.024)	(0.027)
Loss	1.056	0.909	1.062	0.908
	(0.084)	(0.075)	(0.085)	(0.075)
Sales Volatility	0.668**	2.505***	0.670**	2.503***
	(0.108)	(0.433)	(0.109)	(0.433)
Investment Volatility	1.017***	0.994	1.017***	0.994
	(0.004)	(0.005)	(0.004)	(0.005)
CFO_Sales	1.047	2.774***	1.045	2.774***
	(0.116)	(0.568)	(0.116)	(0.568)
CFO Volatility	39.139***	7.310**	39.319***	7.311**
	(31.295)	(6.501)	(31.407)	(6.501)
Litigation Risk	1.154	0.842*	1.156	0.841*
	(0.109)	(0.086)	(0.110)	(0.086)
Slack	1.004	1.010*	1.004	1.010*
	(0.004)	(0.005)	(0.004)	(0.005)
Dividend	0.666***	1.275***	0.665***	1.275***
	(0.055)	(1.114)	(0.055)	(0.114)
Z-Score	0.777***	0.778***	0.777***	0.778***
	(0.032)	(0.040)	(0.032)	(0.040)
Tangibility	6.215***	0.241***	6.203***	0.241***
	(1.380)	(0.549)	(1.378)	(0.063)
K-Structure	0.100***	2.181***	0.101***	2.179***
	(0.025)	(0.031)	(0.025)	(0.549)
Industry K-Structure	0.418	0.051***	0.417	0.051***
	(0.249)	(0.109)	(0.248)	(0.032)
Constant	1.466	0.273***	1.438	0.273***
	(0.514)		(0.506)	(0.110)
Firm Cluster	Yes	Yes	Yes	Yes
Obs	16,637	16,637	16,637	16,637
Pseudo R^2 (%)	8.25	8.25	8.26	8.26

Note: This table presents the exponentiated results from logistic multinomial pooled regressions. The dependent variable is a categorical variable based on the level of unexplained investment. Deviations in the bottom quartile are classified as 'underinvestment' (coded as 1) and deviations in the top quartile are classified as 'overinvestment' (coded as 3). The middle two quartiles are classified as the benchmark group (coded as 2). The first two columns show the results for the first hypothesis, and the last two columns show the results for the second hypothesis. See Appendix 1 for the variable descriptions. The standard errors are shown in parentheses

below the regression coefficients and are corrected for heteroscedasticity. Additionally, observations are clustered by firm. ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively.

Table 6

CEO tenure and deviations from the expected level of investment (Tobin's Q and Sales Growth).

	H1: Early Years		H2: Final Year	
	(1)	(2)	(3)	(4)
Variable	Underinvestment	Overinvestment	Underinvestment	Overinvestment
Early Years	0.935	0.951	0.934	0.951
	(0.055)	(0.059)	(0.055)	(0.059)
Final Year			0.903	1.014
			(0.061)	(0.062)
CEO Ownership	0.995	1.000	0.995	1.000
	(0.006)	(0.007)	(0.006)	(0.007)
CEO Age	0.992**	1.013**	0.992*	1.013**
	(0.005)	(0.005)	(0.005)	(0.005)
CEO Gender	0.850	0.779	0.848	0.779
	(0.144)	(0.139)	(0.144)	(0.139)
Size	0.918***	1.023	0.918***	1.023
	(0.026)	(0.035)	(0.026)	(0.035)
MTOB	1.122***	1.072***	1.122***	1.072***
	(0.023)	(0.027)	(0.023)	(0.027)
Loss	1.111	0.831**	1.116	0.830**
	(0.085)	(0.069)	(0.085)	(0.069)
Sales Volatility	0.713**	2.543***	0.715**	2.540***
	(0.115)	(0.440)	(0.115)	(0.440)
Investment Volatility	1.015***	0.997	1.015***	0.997
	(0.004)	(0.004)	(0.004)	(0.004)
CFO_Sales	1.065	2.247***	1.062	2.248***
	(0.113)	(0.454)	(0.113)	(0.454)
CFO Volatility	27.892***	4.631*	27.995***	4.631*
	(21.314)	(3.983)	(21.382)	(3.983)
Litigation Risk	1.144	0.879	1.145	0.879
	(0.102)	(0.086)	(0.102)	(0.086)
Slack	1.004	1.008	1.004	1.008
	(0.004)	(0.005)	(0.004)	(0.005)
Dividend	0.697***	1.296***	0.697***	1.295***
	(0.055)	(0.112)	(0.055)	(0.112)
Z-Score	0.753***	0.765***	0.753***	0.766***
	(0.030)	(0.039)	(0.030)	(0.039)
Tangibility	5.343***	0.204***	5.334***	0.204***
	(1.142)	(0.051)	(1.141)	(0.051)
K-Structure	0.107***	1.852**	0.107***	1.850**
	(0.026)	(0.445)	(0.026)	(0.444)
Industry K-Structure	0.449	0.072***	0.447	0.072***
	(0.258)	(0.041)	(0.257)	(0.042)
Constant	1.513	0.338***	1.487	0.339***
	(0.518)	(0.132)	(0.511)	(0.133)
Firm Cluster	Yes	Yes	Yes	Yes
Obs	16,637	16,637	16,637	16,637

Pseudo R^2 (%)	7.96	7.96	7.97	7.97

Note: This table presents the exponentiated results from logistic multinomial pooled regressions. The dependent variable is a categorical variable based on the level of unexplained investment. Deviations in the bottom quartile are classified as 'underinvestment' (coded as 1) and deviations in the top quartile are classified as 'overinvestment' (coded as 3). The middle two quartiles are classified as the benchmark group (coded as 2). The first two columns show the results for the first hypothesis, and the last two columns show the results for the second hypothesis. See Appendix 1 for the variable descriptions. The standard errors are shown in parentheses below the regression coefficients and are corrected for heteroscedasticity. Additionally, observations are clustered by firm. ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively.