CEO age and firm risk in CEO successions

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Master's Thesis
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Spring 2015
Accounting

Approved in the Department of Accounting ___ / ___20____ and awarded the grade

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Table of contents

List of tables

TABLE 1. SUMMARY OF THE RELEVANT LITERATURE

TABLE 2. DESCRIPTIVE STATISTICS

TABLE 3. DESCRIPTIVE STATISTICS AND PAIRED SAMPLES T-TEST RESULTS FOR PRE-AND POST-SUCCESSION SUBSAMPLES

TABLE 4. PAIRED SAMPLES T-STATISTICS FOR VOLATILITIES

TABLE 5. CORRELATIONS

TABLE 6. CORRELATIONS BETWEEN THE LOGARITHMIC VARIABLES

TABLE 7. SUMMARY STATISTICS FOR THE REGRESSION MODEL 1

TABLE 8. REGRESSION COEFFICIENTS AND COLLINEARIY STATISICS FOR THE REGRESSION MODEL 1

TABLE 9. RELATIVE IMPORTANCE OF THE INDEPENDENT VARIABLES

TABLE 10. F CHANGE TEST FOR THE EXISTENCE OF AN INTERACTION

List of figures

FIGURE 7. SCATTERPLOT OF THE REGRESSION 2 RESIDUALS (ADDITIONAL CONTROL VARIABLES INCLUDED)

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Title of thesis CEO age and firm risk in CEO successions

Degree Master of Science (Economics and Business Administration)

Degree programme Accounting

Thesis advisor(s) Henry Jarva

Year of approval 2015   **Number of pages** 64   **Language** English

Abstract

The purpose of this thesis is to investigate the relationship between CEO age and firm risk. There is extensive evidence in the academic literature suggesting that age is negatively related to risk seeking in decision-making and investment behavior. Theoretical research on CEO risk seeking and tenure also supports the hypothesis to some extent. Empirical evidence on the relationship between CEO age and corporate risk supports the prediction of a negative relationship especially robustly.

   The sample of this study consists of 2224 CEO observations from U.S. stock exchange listed companies. Observations are chosen from around CEO successions so that both the predecessor and the successor CEO are included in the sample. This paired sample design should enable excluding fixed firm effects from the analysis. The data is analyzed with IBM SPSS Statistics and Excel, using paired samples t-test, correlation and regression analysis.

   Results of this thesis suggest that there is a negative relationship between CEO age and stock return volatility. CEO succession is also negatively related to volatility: CEO change triggers a decline in corporate risk. Furthermore, the relationship between CEO age and stock return volatility is moderated by CEO change. The relationship is still negative after the successions, but less pronouncedly.

    The relationship between CEO age and corporate risk can be explained by either CEO impact or CEO-firm matching or (presumably) by both. The decline in the volatility triggered by CEO change might relate to decreasing investor uncertainty after the new CEO is appointed and has been in office for a while. Furthermore, the interaction effect between CEO change and age is possibly related to CEO career horizon and tenure issues.

Keywords Risk seeking, CEO demographics, CEO age, firm risk, CEO succession

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Hyväksymisvuosi 2015	**Sivumäärä** 64	**Kieli** Englanti

Tiivistelmä

Tämän maisterin tutkielman tavoitteena on tutkia toimitusjohtajan iän ja yrityksen riskin välistä yhteyttä. Akateemisessa kirjallisuudessa on vahvaa näyttöä siitä, että henkilön ikä on negatiivisesti yhteydessä riskinottoon päätöksenteossa ja sijoittamiskäyttäytymisessä. Toimitusjohtajan riskinoton ja toimikauden pituuden (ja/tai urahorisontin) välistä yhteyttä tarkastelevat teoreettiset tutkimukset tukevat myös osittain vastaavaa hypoteesia. Erityisen vahvaa näyttöä iän ja riskin välisestä yhteydestä tarjoaa empiirinen tutkimus toimitusjohtajan iän ja yritysriskin suhteesta.

Tämän tutkimuksen otos koostuu 2224 toimitusjohtajahavainnosta yhdysvaltalaisista suurista pörssiyrityksistä. Havainnot on valittu toimitusjohtajan vaihdosten ympäriltä niin, että otokseen on valikoitunut samasta vaihdoksesta sekä edeltäjä- että seuraajatoimitusjohtaja. Tällainen parittainen asetelma mahdollistaa oletetusti häiriömuuttujien pois jättämisen tilastollisesta analyysista. Aineiston analysointiin käytetään IBM Statistics - ja Excel-ohjelmia. Analyysissa käytetään parittaisia t-testejä sekä korrelaatio- ja regressioanalyysia.

Tämän tutkielman tulokset osoittavat, että toimitusjohtajan iän ja yrityksen osaketuoton volatiliteetin välillä on negatiivinen yhteys. Toimitusjohtajan vaihdos on myös negatiivisesti yhteydessä volatiliteettiin: Toimitusjohtajan vaihdos aiheuttaa yrityksen riskin vähentymisen. Toimitusjohtajan vaihdos myöskin moderoi iän ja riskin välistä yhteyttä. Yhteys on vaihdosten jälkeen edelleenkin negatiivinen, mutta heikompi.

Toimitusjohtajan iän ja yrityksen riskin välinen yhteys voi selittyä sekä toimitusjohtajan yrityksessä tekemillä muutoksilla että toisaalta yritysten ja toimitusjohtajien välisellä gravitaatiolla. Toimitusjohtajan vaihdoksen aiheuttama riskin vähentyminen puolestaan on selitettävissä sijoittajien epävarmuuden vähentymisellä uuden toimitusjohtajan astuessa virkaan ja toimiessa yrityksessä. Vaihdoksen ja iän välinen interaktiovaikutus taasen saattaa liittyä toimitusjohtajan toimikauden pituuteen ja urahorisonttitekijöihin.

Avainsanat Riskinotto, toimitusjohtajan demografiset piirteet, toimitusjohtajan ikä, yrityksen riski, toimitusjohtajan vaihdos

1. Introduction

The purpose of this master's thesis is to investigate the relationship between CEO age and corporate risk. Prior empirical research suggests than age is a significant factor explaining personal and corporate level risk-seeking behavior, but findings on the direction of the effect are somewhat mixed. Also theoretical studies offer different predictions of the relationship, depending on the assumptions and frameworks of the models.

Evidence on the effect of CEO age on firm risk is scarce. To my best knowledge, only two recent studies have examined the subject, both using different kind of approaches and variables. The contribution of this thesis is to model the relationship using a CEO succession structure. I observe CEO succession events and my sample constitutes of predecessor and successor CEOs from time periods t-1 and t+2, t being the year of CEO turnover. This matched pair structure should allow me to control fixed firm effects and to include a CEO change variable in the model. Former literature suggests that CEO change itself triggers changes in the stock return volatility and that firms with different levels of uncertainty might carry out forced turnovers to a different extent. Hence, it seems reasonable to separate the effect of CEO change from the impact of CEO age that typically changes in the succession. Former studies do not take into account this potential individual effect of CEO change. All in all, since prior theoretical and empirical findings on the effect of age on risk seeking are conflicting and since the academic literature lacks versatile investigation of the relationship between CEO age and firm risk, this study is a relevant contribution to the academic study of the subject.

CEO recruitment is a strategically important event in a corporation. CEOs are figureheads of their companies and investors might change their conceptions of firms' risks and prospects due to CEO turnovers. Also CEO age could affect these evaluations. Furthermore, CEOs of different ages might either enforce or weaken the fulfillment of firms' longer term risk preferences and strategic plans. If it can be shown that CEO age is a relevant predictor of firm risk, companies should consider the age aspect when recruiting new CEOs. CEOs of different ages might also gravitate to firms with different risk profiles. It is valuable for the firm to know, which kind of companies potential CEOs prefer to apply to. For example, if younger CEOs gravitate to more volatile firms on average, low-

risk firms that seek to increase their upside risk might want to attract younger CEO candidates by emphasizing the pursuance of a new, more dynamic strategy.

CEO age is an interesting perspective to corporate governance field since it is a demographic feature and may not thus be automatically attributed relevance. On the other hand, stereotypical conceptions can sometimes guide perceptions of individuals' features and this might affect CEO recruitment. Hence, it is useful to examine age-related issues scientifically to avoid acting on biased conceptions or ignorance. Furthermore, mechanisms behind the relationship between age and risk seeking are delicate and complex and relate to both personal and career-specific issues. Both psychological and economic considerations as well as shareholder interests play a key role in determining the mechanism. In the field of psychology, the subject has been studied by examining individuals' decision-making. Researchers have typically used so called choice-dilemma tests to study how younger and older subjects choose between actions with different risks and rewards. Risk taking in decision-making has also been examined in the field of economics. Scholars have investigated the risk-seeking patterns in managers' decision-making and studied whether there is age-related variance in their behavior. Economics and managerial business literature have also contributed to the study of this subject by examining the relationship between age and investment behavior. Portfolio allocation can be used as a proxy for risk seeking since different financial instruments involve different risks and rewards.

The principal-agent model is the most common theory to explain why managers' and shareholders' risk preferences diverge from each other. It has also been applied to the theoretical modelling of the relationship between managerial age and risk seeking. Employment risk and career concerns are other important concepts that have been used to theoretically predict age-related variance in risk preferences and risky behavior. The problem of these models is that the underlying assumptions differ from each other significantly and the conclusions are often conflicting. Fortunately, there is also some empirical evidence on the relationship between CEO age and corporate risk. Two studies have examined the effect of CEO age on an explicit firm risk measure. Furthermore, some scholars have examined, through which channels corporate risk is adjusted and

have also found some interrelations to CEO seniority. These studies do not, however, focus on this issue specifically but more as a side note.

It has to be noted, that the research on individuals' personal risk seeking and the studies of CEO age and corporate risk differ from each other when it comes to predicting causality. By personal risk seeking, I refer to individual's choices between different courses of action. Results on risk-seeking behavior and attitudes are more direct pieces of evidence on the relationship between age and risk preferences than corporate-level studies. A correlation between CEO age and firm risk does not necessarily imply that CEOs of different ages would imprint their diverging risk preferences to actual firm practices and that this would cause the detected relationship. This is actually not likely to be the only (or the most important mechanism) in place. Instead, it is likely that firms and CEOs of different ages are matched with firms of varying risk profiles. This matching is likely to be reciprocal: Younger CEOs might gravitate to more dynamic and volatile businesses, whereas older CEOs might feel at home in more conservative and stable firms. On the other hand, more volatile companies could be hypothesized to seek more innovative and dynamic new leaders and to choose younger CEOs. Less risky firms might prefer more tenured and experienced older CEOs that are willing to hold on to the status quo of the corporation.

Compensation issues are also relevant for this thesis since incentive pay is supposed to encourage managerial risk taking. In this thesis, I focus on two components of CEO incentive pay: delta and vega. Delta is the dollar change in managerial wealth associated with a 1% change in the firm's stock price and vega is the dollar change in wealth associated with a 0,01 change in the standard deviation of the firm's stock returns (Coles et al., 2006). Both of these measures have been found to contribute to managerial risk incentives and are thus included in the analysis.

As my sample, I use CEO successions in S&P1500 index companies that offer top executive compensation information in the ExecuComp database. Observations are from years 1992-2010 (year 1992 being the first year of available executive data) and they are limited to CEOs that have tenure of minimum three years. The main research question is whether CEO age is related to stock return volatility that is used as a proxy for corporate risk. I control for CEO incentive compensation that can be hypothesized to impact risk-seeking behavior. In addition to the main research question,

3

I explore whether CEO change itself triggers changes in the firm's stock return volatility. There is evidence in the academic literature supporting this hypothesis. Furthermore, I strive to examine if the relationship between age and risk is different before than after the observed CEO turnovers. CEO career horizon and tenure can be hypothesized to impact the relationship but the research design of this study makes it impossible to control these variables. Thus, it might be that these factors affect the detected relationship and manifest themselves as an interaction effect between CEO change and age. As a final issue I test if CEO age is related to investors' conceptions of the firm's future growth prospects. As a proxy for expectations, I use market-to-book ratio. Statistical analysis is conducted mainly with IBM SPSS Statistics and partly with Excel. I use paired samples t-test, correlation and regression analysis to examine the statistical relationships between the variables.

My thesis is structured as follows. In chapter 2, I introduce relevant academic literature. I first present literature examining individual's personal risk preferences and behavior, involving both psychological and economic literature on risky choice in decision-making and investment behavior. I will also present evidence to support the hypothesis that personal risk preferences affect corporate level decision-making and policies. After that, I move on to a more career-specific perspective to risk taking. I will describe the principal-agent problem to lay grounds for the models of managerial seniority and risk taking and then introduce theoretical predictions of the relationship between tenure, career horizon and risk seeking (in this thesis, age is used as a proxy also for tenure and career horizon). After introducing theoretical contributions, I will present empirical findings on the relationship between CEO age and corporate risk. Findings on both direct and more indirect risk measures are reported. The last two sections of my literature review introduce research on CEO compensation and on the effect of CEO succession on corporate risk. The chapter is concluded with a summary of the relevant literature and the construction of the hypotheses. In the third chapter, I will introduce my data and research method. Results of the statistical analysis are presented in chapter 4. Chapter 5 concludes.

2. Literature review

In this chapter, I strive to develop an extensive understanding of the relevant academic literature that examines the relationship between age and risk taking. Psychological, investment-related, career-specific and corporate-level aspects are discussed. The literature review is concluded with a summary.

2.1. Age and risk in individuals' decision-making – a psychological perspective

Psychological research on individuals' risk tolerance has typically focused on examining how people make decisions. Wallach and Kogan (1961) explored the effect of age on risk taking in their seminal research paper. The research setting was based on a survey with choice-dilemma situations where the participants had to choose between more and less risky alternative courses of action. The questionnaire constituted of 12 decision-making situations and the subjects had to choose between a certain and a more desirable but less safe alternative. They also had to indicate probabilities that would be sufficient for choosing the riskier option. (Cited in Brockhaus, 1980) Wallach and Kogan found that college students, regardless of their sex, were less conservative than elderly subjects.

Mata, Josef, Samanez-Larkin and Hertwig (2011) find conflicting evidence on the relationship between risky choice and age in their meta-analysis. They make a distinction between two different kinds of decisions: decisions from description and decisions from experience. The former refers to a priori probabilities, i.e. to situations where the risk can be calculated beforehand with fairly simple mathematical equations. Decisions from description are based on classical probabilities. The latter form of decision making, on the other hand, requires experience from similar events and is equivalent to statistical probabilities. Mata et. al (2011) find a slight tendency of younger adults to seek more risk than the older ones in decisions from description but note that the relationship is not systematic. The aggregate meta-evidence on decisions from experience suggests significant age-related differences, but the relationships are conflicting in different choice-dilemma tasks. Older participants were less risk tolerant in some but more risk seeking in other tasks, compared to

the younger subjects. Overall, the meta-analysis does not find strong evidence to suggest that there would be a clear pattern in aging and risk-seeking.

Attitudes towards risky choice have been examined also specifically among managers. Vroom and Pahl (1971) used Wallach and Kogan's choice dilemma test (Wallach and Kogan, 1961) to explore 1484 managers' attitudes towards risk and concluded that there is a significant negative relationship between risk tolerance and manager's age, although the relationship was statistically significant only when using mean instead of individual scores. The researchers discussed two possible explanations for the discovered relationship. As individuals age, they get married and have kids and become responsible for other people and this might encourage them to avoid excessive risk taking. Another possible reason for the declining risk tolerance is socio-cultural development. Because the study was cross-sectional, it is possible that birth cohorts play a key role in explaining the findings. Younger respondents were less likely to have experienced volatile and rough political and economic conditions than the more senior age groups.

Taylor (1975) also examined managerial decision-making processes and found that age had a dominant effect on decision-making processes compared to prior work experience. It took a longer time for older managers to reach decisions even when controlling the work experience factor. Older managers tended to look for greater amounts of information before making decisions. They were also less confident of their decisions and more eager to alter them later on if adverse consequences appeared. Taken together, these findings suggest that younger managers make faster decisions that are based on smaller amounts of information and this could imply riskier decision-making. One issue related to this is cognitive ability that has been shown to correlate positively with risk seeking (Dohmen et al., 2010). Furthermore, time pressure has been found to increase risk aversion (Ben Zur and Breznitz, 1981). Since adulthood cognitive ability decreases with age (Salthouse, 2009), older managers are likely to feel more time pressure in decision-making under time constraints and can thus be hypothesized to behave more risk-aversively.

Prendergast and Stole (1996) conclude that managers tend to behave according to two key psychological principles when making investment decisions: 1) base rate fallacy and 2) sunk cost

fallacy. Both refer to common biases in human thinking. Base rate fallacy denotes the tendency to overlook information on population distributions when making decisions. Sunk cost fallacy, on the other hand, refers to the predisposition to commit more resources to a failing cause in order to justify prior actions. These fallacies are equivalent to common patterns in managerial decision-making. Base rate fallacy occurs when managers overreact to new information and overlook probabilities of the whole situational setting. Sunk cost fallacy surfaces as executives avoid reputation losses and try to bring forward their past decisions in a good light. Terminating projects or altering them significantly would signal prior failure and thus, managers tend to hold on to their investments without modifying or quitting them. These tendencies also relate to age. As new (and on average younger) managers enter investment projects, they exaggerate the importance of new information. This new information is pronouncedly colored with subjective preferences and conceptions and since new managers want to signal their ability by highlighting the importance of their personal information, new managers are likely to bias the decision-making process. More senior managers, on the other hand, have been involved in the projects for a longer time and the sunk cost fallacy is dominating their behavior. Based on this argumentation, Prendergast and Stole hypothesize that managers with shorter tenures engage in more aggressive and riskier investment behavior, whereas longer-tenured executives behave excessively conservatively.

Child (1974) finds that management youth is related to fast but volatile growth. He does not attribute this finding to risk tolerance directly but some inferences can be drawn. Child shows that younger managers are more likely to challenge formal corporate rules and feel more pressure for change than older managers. They also see themselves as more competent than do their older colleagues. From these findings, Child draws a conclusion that "younger men are able to expend more physical and mental effort on promoting the change and growth of their companies" (pp. 183). Since high and volatile growth calls for higher risk seeking, the study implicitly suggests that the attitudes and mental processes of young managers boost riskier activities.

2.2. Age and risk in individuals' investment behavior

In economic literature, risk tolerance and risk aversion are typically measured by gathering and analyzing information on individuals' investment behavior. Chang et al. (2004) make a distinction

between subjective and objective risk tolerance. By subjective risk tolerance they refer to an individual's own conception of his or her risk tolerance. Psychological studies typically measure subjective risk tolerance since answering choice-dilemma questionnaires calls for subjective assessment. Alternatively, behavioral variables can be used as proxies for risk taking. Chang et. al refer to these measures as objective risk tolerance: Individuals' risk-seeking attitudes are examined by measuring their actions and drawing conclusions based on the observed behavior. A typical measure of objective risk tolerance is risky assets' share of the total portfolio.

Also the relationship between age and risk tolerance has been studied by exploring how individuals and households of different ages make investment decisions. Baker and Haslem (1974) collected a sample of 1623 customers of brokerage firms from Washington D.C. and asked the participants to point out the relative importance of different portfolio risk and return items. The authors find a significant, positive relationship between age and the importance of marketability of financial assets, suggesting a negative relationship between age and economic risk seeking. On the on hand, age was not statistically significantly related to the other measured indicators of risk seeking (market risk and price stability).

Morin and Suarez (1983) find a positive relationship between investor's risk aversion and age. The increase in risk aversion is uniform but the strength of the relationship depends on individual's wealth. If the wealth level is between \$12 500 and \$100 000, the effect of age on risk aversion is stronger than on wealth levels above \$100 000. This suggests that age is an important determinant of investor risk seeking especially when the individual does not possess a large amount of assets. Bakshi and Chen (1994) find support for the life-cycle hypothesis of risk aversion. They examine if longitudinal demographic changes bring about changes in market equilibrium risk premiums and conclude that the experienced rise in the average age after the post-WW2 baby boom has been succeeded by one. Also Hawley and Fujii (1993-1994) as well as Lease at al. (1974) find evidence supporting a negative relationship between age and risk tolerance in individual investors' financial decision-making.

There are also opposite results in the academic research on age and financial risk tolerance. Wang and Hanna (1997) find support for the hypothesis that financial risk aversion decreases with age. As the head of the household gets older, the ratio of risky assets to total wealth increases. They contemplate that the relationship might arise from the fact that younger individuals typically have less financial wealth than older ones and thus have weaker back-up resources in case of a financial loss. Weagley and Gannon (1991) gain similar results using a multi-nominal logit model and conclude that households take increasing amounts of risk in their asset allocation when they age, but at a decreasing rate of change. After the head of the household turns 60, the riskiness of the portfolio starts to diminish. Also Riley and Chow (1992) found a similar pattern in their research on a random sample of US households: Risk aversion decreases with age until the age of 65, after which it starts to increase. Sung and Hanna (1996b), on the other hand, do not find a significant relationship between age and the level of risk tolerance.

Although there are numerous findings in the literature on the relationship between age and investor risk tolerance, the effect of pure age on risk attitudes can be questioned. Because most of the studies are conducted based on cross-sectional data, it remains unclear whether the discovered relationships arise from differences within or between individuals. Jianakoplos and Bemasek (2006) strive to distinguish between the effect of age and birth cohort on investment risk. They conclude that the "pure age effect" in risk seeking is negative but that the birth cohort effect is actually the opposite: Younger birth cohorts choose less risky portfolios than the older cohorts. The researches contemplate that this tendency might arise from historical developments in pension and social security systems that have led to a greater sense of financial security in the US.

Also Yao et al. (2011) decompose the relationship between age and investor risk tolerance. They divide survey respondents into three birth cohort categories: Birth years between 1928 and 1945 were categorized into the "Silent generation", respondents born between 1946 and 1964 were identified as "Baby boomers" and the birth cohort of 1965-1980 was defined as the "Generation X". Most of the Silent generation experienced major political unrest of WW2 and cold war and some of them remember the repercussions of the 1929 stock market crash and the great depression. Stock market volatility was high during 1930s, 1940s and 1950s and the forms of media available

were limited. Financial information did not gain very much media space, people were not familiar with financial institutions and instruments and participation on capital markets was limited. The Baby boomer generation, on the other hand, experienced high but relatively volatile market growth in their adult age. They were adults during the Vietnam War and experienced the substantially negative market returns in 1973-1974, as well as the Black Monday in 1987. Financial uncertainty was nevertheless substantially lower for this generation than for the previous one. The financial distress continued to decline in the adult years of the Generation X. Market returns and economic performance were consistently high during the 1990s and the first decline did not happen until 2001. This generation is also familiar with using the Internet and having an easy access to a large amount of financial information.

Based on these premises, Yao et al. hypothesize that younger birth cohorts are more risk tolerant than the older ones. Surprisingly and conflicting with the findings of Jianakoplos and Bemasek, the results do not confirm this generation effect. Controlling other variables, generation does not significantly relate to risk tolerance. On the other hand, similar to the findings of Jianakoplos and Bemasek, "pure age" was found to be a significant predictor of declining financial risk-seeking attitudes. The researchers also discuss possible reasons for this relationship. As a person ages, his or her time horizon shortens and the opportunities to retrieve financial losses diminish. It is also possible that people who approach retirement might shift their focus from asset accumulation to asset preservation to provide for the future income cutback. This transition requires a decline in the amount of financial risk taken.

2.3. Personal and corporate level risk seeking

The above presented findings suggest that there evidently seems to be a relationship between an individual's age and his or her risk tolerance. It is valid to question, however, whether managers and their personal risk attitudes affect corporate policies and characteristics. If findings on individuals' psychological and personal-life economic risk-seeking behavior are used as a basis for hypothesis construction, there should be solid arguments to justify the consistency between personal risk tolerance/aversion and corporate level risk taking. Cain and McKeon (2013) report that CEOs' personal risk tolerance is related to corporate risk. They find that CEOs that hold small

aircraft pilot licenses run companies with higher leverage ratios. Also stock return variability and acquisition frequency are higher in these companies. Holding a piloting license is used as a proxy for risk-seeking behavior since piloting has been shown to be related to higher mortality (McFall, 2012).

Cain and McKeon (2013) refer to the correspondence of CEO personal risk seeking and riskier corporate policies as behavioral consistency. Behavioral consistency denotes a perception that individuals behave consistently in different contextual settings (Cronqvist et al., 2012). Cronqvist et al. (2012) examine the behavioral consistency between CEO personal and firm leverage and find that there is a positive, significant relationship between these two variables. This relationship can be attributed to both endogenous firm-manager matching but also to CEO's impact on corporate policies. The latter form of influence is supported by the detected relationship between weaker corporate governance measures and stronger correspondence of CEO home and firm leverage. Firms with weaker CEO monitoring enable their CEOs to imprint their personal incentives on firm policies. Malmendier and Tate (2005) also find support for behavioral consistency in their study of overconfident CEOs. Overconfidence is defined as CEO's unrealistic expectations of firm's future profits, measured by the failure to divest firm-related risk in personal portfolios. The authors find that overconfident CEOs tend to have a bias in their acquisition behavior: Acquisitions are pronouncedly sensitive to cash flows.

Bertrand and Schoar (2003) construct a panel data to examine the manager fixed effects on corporate-level decision-making and performance. All the observed managers have been working in at least two firms over time, so the firm fixed effects and time-varying corporate features can be controlled. On average, the adjusted R squared increases by over four percentage points when manager fixed effects are included in the models that explain firm practices. The impact of the manager is especially important in diversification and acquisition decisions, cost-cutting policy, interest coverage and dividend policy. The authors also find evidence that supports the hypothesis that managers have different, distinguishable management styles, where certain patterns of decision-making unite. These styles then further affect the corporate practices of firms.

In conclusion, academic literature suggests that CEOs' incentives and characteristics have a real effect on corporate policies. Thus, the hypothesis that CEO age is related to firm riskiness is reasonable also from the perspective of CEO personal risk preferences.

2.4. Career-specific perspective to managerial risk seeking

In addition to empirically examining how investment behavior and managers' decision-making processes vary with age, economic literature has theoretically predicted managerial risk-seeking behavior. This strand of literature is more focused on career-specific issues than the decision-making studies. Agency problem is the theoretical cornerstone for explaining managerial risk taking and its divergence from that of shareholders'. Furthermore, agency issues are tightly connected to how managerial risk seeking can be hypothesized to change along manager's tenure and career horizon. In the following, I will first introduce standard agency theory and then proceed to discuss predictions of the relationship between tenure (and career horizon) and managerial risk seeking.

2.4.1. Agency problem and risk reduction incentives

Agency costs arise when a firm's control and ownership are separated. In practice, this separation means that the firm is lead and operated by hired employees: managers and their subordinates. A perfect incentive alignment of the owner (principal) and the employee (agent) occurs only when the employee owns 100 percent of the firm equity. In this case, the agent will expend firm resources up to the point where his additional gain in firm wealth equals the expenditure, ceteris paribus. On the other hand, when he owns less than 100 percent of the wealth, he will expend an additional dollar of the company's resources until the gain equals the dollar share of his own ownership. In other words, he will not operate at the utility-maximizing equilibrium of the shareholder, but rather that of himself. This divergence of equilibriums is called the principal-agent problem (also "agency problem" and "moral hazard"). (Jensen and Meckling, 1976)

There are two problems arising from the principal-agent relationship: 1) divergence in goals and 2) divergence in attitudes towards risk (Eisenhardt, 1989). The latter one is relevant to this thesis.

Shareholders are hypothesized to behave risk-neutrally due to their possibility to diversify risk on capital markets. Managers, on the other hand, are likely to be risk averse since they are unable to diversify their human capital. Managers' human capital related wealth is tied to corporate performance to an extent that depends on the value of that asset to other companies, i.e. on his or her alternative job opportunities. (Amihud et. al, 1986) So essentially, this explanation of risk reduction refers to "employment risk", the risk of losing one's position in the firm (Amihud and Lev, 1981). Amihud and Lev (1981) also point out that managers engage in risk reduction activities to compensate for the agency costs imposed on them. According to Jensen and Meckling (1976), capital markets anticipate the agency costs and adjust the managerial compensation to account for the expense. In order to offset this cost, managers strive to reduce their employment risk (Amihud and Lev, 1981).

Another important aspect of the principal-agent theory is information asymmetry. The more the principal has information on the agent's behavior, the more likely the agent is to align her behavior with the principal's interests (Eisenhardt, 1989). In an ideal situation, the agent's actions could be perfectly observed, and his or her compensation could be solely based on detected behavior. In practice, however, managers cannot be perfectly observed and thus, their compensation needs to be at least partly outcome-based (Eisenhardt, 1989). This introduces another problem: Because the relationship between managerial effort and firm performance involves exogenous factors that cannot be controlled by the manager, outcome-based compensation exposes managers to risk. To mitigate this risk, managers might engage in risk-reducing activities that eat up stockholder value. (Amihud and Lev, 1981)

Hirshleifer and Thakor (1992) combine the above mentioned aspects and attribute risk reduction to managerial careers and so called reputation building. While stockholders are interested in the pure asset value, managers are concerned about the *perceived* value of their human capital. Since the project choices of the manager cannot be fully observed, performance must be evaluated based on ex post analysis of success of failure. Thus, managers strive to promote favorable inferences, even though this would lead to rejecting high-risk, positive net present value projects. One issue related to this is the asymmetry in the timing of good and bad news (Holmström, 1999). Because

13

the consequence of early failure of a project is generally termination and because success often realizes in longer term, managers might be eager to avoid early reputation losses by cutting risky projects. For the manager, a key variable is the likelihood of success, because the perception of his or her talent builds upon this factor. Managers will avoid projects that will reveal their actual talent and prefer investments with as few exogenous risk factors as possible. The shareholder, on the other hand, is not mainly interested in the likelihood of success, but instead of the actual payoffs of the project. But then again, the final outcome is not so much relevant for the manager. (Holmström, 1999)

The reputation building hypothesis might also relate to herd behavior. Investment decisions can be distorted if the agent is concerned about his or her reputation as a sensible decision maker (Keynes, 1936; cited in Scharfstein and Stein, 1990). Managers may strive to behave in a consistent manner with other executives in order to show their alignment with common investment patterns and this way signal their capability. Another motive for alignment of actions might be blame-sharing in case of a failure (Scharfstein and Stein, 1990). Scharfstein and Stein (1990) point out, however, that problems of herding behavior are less severe if managers have a larger set of opportunities on the labor market and if their compensation is performance-related.

All in all, the agency theory predicts that managers will take insufficient amounts of risk and destroy shareholder value by doing so. Above, I presented general reasons for the divergence in risk-seeking attitudes. In the following, I will introduce how age might further alter managerial risk seeking.

2.4.2. Career horizon, tenure and risk seeking

Standard agency theory suggests that moral hazard eases with tenure. As tenure increases, shareholders have a more accurate conception of the manager's talent and have presumably discovered more efficient ways to monitor the agent. This, in turn, should reduce the incentive conflict. Nevertheless, CEO career horizon considerations propose the opposite. Matta and Beamish (2008) argue that legacy conservation plays an important role in explaining why risk aversion increases as CEOs approach retirement. Legacy issues refer to managers' willingness to

leave a good impression of their competence and performance after leaving the company. Regarding risk seeking, this is likely to imply avoidance of high-risk project initiatives that could jeopardize short-term returns. Legacy considerations are linked to many psychological phenomena found in decision-making literature. Kahneman and Lovallo (1993) find that deferral of outcomes, especially possible accusations, encourages the decision-maker to take more risk and to evaluate the decision more thoroughly from multiple different perspectives. If the outcome realizes in a shorter run, the decision-maker has a tendency to act on short-term grounds and to avoid decisions that have a large downside risk. Studies that have examined regret have shown that decision-makers evaluate their possibility to reverse negative outcomes and use this ability as a decision-making criterion (Gilovich and Medvec, 1995). The incapability to undo a regretted action increases individual's risk aversion (Josephs et al., 1992). From these findings, one can easily draw the conclusion that CEOs approaching retirement are likely to avoid extensive risk taking. Because the CEO cannot control the outcomes and try to fix negative end results after retiring, he or she chooses not to engage in risky projects. The fact that CEOs often remain active in corporate boards after their retirement (Brickley et al., 1999) might further strengthen the effect of legacy considerations.

In addition to legacy and decision-making issues, the career concern perspective can also be applied to predicting the relationship between tenure/career horizon and risk seeking. Empirical evidence suggests that younger managers are more likely to be punished from poor results. Chevalier and Ellison (1999) and Hong et al. (2000) find that younger and less experienced mutual fund managers and analysts are more easily dismissed due to inadequate performance. In line with these findings, Gregory-Smith et al. (2009) discover that the likelihood of forced exit due to poor performance increases in the first four years of CEO tenure but declines after that. These empirical findings suggest that younger managers are exposed to a greater employment risk than older ones and can thus be hypothesized to be more concerned about their careers. There are also theoretical predictions in the academic literature suggesting that career concerns are more pronounced for shorter tenured, younger managers. According to Holmström (1999), the moral hazard in principal-agent relationships arises fundamentally from the agent's employment risk and the difficulty to diversify one's human capital. The uncertainty about the employee's talent increases the agent's employment risk. According to Holmström, managers benefit from avoiding risky projects and

from claiming that those projects would not have been profitable. Because shareholders have few means to invalidate these claims, a serious incongruence of risk-seeking incentives arises and shareholder wealth is diminished. Since the uncertainty about one's talent is greater for younger employees who have fewer credentials and less proof of their competence, it could be assumed that moral hazard is more substantial for younger managers with shorter tenures. As there is less information about younger managers' ability, they have an especially strong incentive to hide project-related information and to avoid risk.

Zwiebel (1995) discusses the relationship between innovativeness and management seniority in a similar vein with Holmström (1999). He presumes that the market's inference of a manager's talent becomes more precise as the tenure lengthens. As precision increases, manager's reputation will be less dependent on future performance. In Zwiebel's model, costs and benefits of undertaking a new action go to zero as the precision of talent evaluations approaches infinity. Furthermore, it can be shown that under the assumptions used in Zwiebel's theoretical analysis, costs sink quicker than benefits. As a consequence of this train of thought, it can be inferred that it is more beneficial for more senior managers to undertake new actions.

Also Gibbons and Murphy (1992) argue that younger CEOs have stronger career concerns than older ones, but unlike Holmström and Zwiebel, they implicitly predict that risk seeking decreases with tenure. According to Gibbons and Murphy, career concerns act as an implicit incentive to align actions with shareholder preferences. Since younger managers have stronger career concerns than older ones, moral hazard can be assumed to be less severe for less tenured, younger managers. Younger managers' prospective career is longer and thus, the return to changing the market's belief is higher. According to Gibbons and Murphy, this encourages younger managers to take more costly actions to prove their ability to markets. Although they do not explicitly mention that this would imply greater risk seeking, this conclusion can practically be drawn. If the agency problem is assumed to lead to sub-optimally low levels of managerial risk taking, stronger alignment with shareholder interests can be assumed to result in greater risk seeking.

May (1995) also discusses managerial risk taking from a human capital point of view. But unlike Gibbons and Murphy (1992) and Holmströn (1999) who emphasize the significance of talent signaling and market beliefs, he attributes the development of risk-seeking attitudes to specificity of human capital. As tenure lengthens, manager's knowledge becomes increasingly firm-specific and this raises the employment risk and may encourage the manager to avoid risky projects and risk-seeking strategic alignments. Thus, in accordance with Gibbons and Murphy, May also predicts that risk taking decreases with tenure.

Taken together, the above results offer diverging predictions of the relationship between tenure and risk seeking. The legacy conservation perspective predicts that older managers with short career horizons avoid risks. The incapability to undo regretted actions and to defer outcomes further encourages managers to reduce risk taking when approaching retirement. The career concern aspect, on the other hand, offers varying predictions of the relationship between tenure and risk seeking. These differences arise from the assumptions that are employed in the theoretical models. First of all, some academics assume that younger managers have stronger career concerns (Holmström, 1999; Gibbons and Murphy, 1992), whereas others presume that employment risk increases with tenure (May, 1995). Secondly, the effect of career concerns is predicted variously by different scholars. Some assume that career concerns mitigate moral hazard and encourage risk taking (Gibbons and Murphy, 1992), while others predict that career concerns impel managers to avoid failures and risk (Holmström, 1999). Divergences in the assumptions lead to different hypotheses of the relationship between tenure, career horizon and risk seeking and thus, the findings of these theoretical studies do not offer a solid basis for the hypothesis construction of this thesis. Fortunately, there is also empirical evidence to support the hypotheses. In the following, I will introduce findings on the relationship between CEO age and firm risk. I first present studies that use direct risk measures as dependent variables. After that, I will discuss which variables might mediate changes in corporate risk, and how CEO age and tenure are related to these factors.

2.5. Empirical findings on CEO age and corporate risk

Since age can be hypothesized to affect an individual's attitude towards risk, and since this attitude affects the principal-agent relationship and firm performance, it is relevant to examine how CEO

age and corporate risk are related to each other. There are a couple of studies examining the relationship between CEO age and firm riskiness. Elsaid and Ursel (2012) estimate the change in the firm risk due to a changing CEO age in CEO successions. Using industry adjusted standard deviation of cash flows as the risk measure, the authors find that a change in CEO age has a negative, significant relationship with a change in firm risk. The researchers admit that although it might be possible that CEO age affects firm risk, the causality could also work in the opposite direction: Companies with certain risk profiles might be willing to choose CEOs of certain ages.

Serfling (2014) also examines the relationship between CEO age and corporate risk and finds a negative relationship between age and stock return volatility. Serfling also investigates, through which channels CEO age affects firm riskiness and concludes that the intensity of R&D investments, diversification in acquisitions and operations as well as the level of operating leverage transmit the effect of age on firm risk. He also takes into account the possible influence of the second most influential executive and finds out that his or her age also influences both stock return volatility and the channels transmitting the effect.

Serfling (2014) strives to examine the dynamics of CEO age and corporate risk delicately. He concludes that CEOs imprint their personal risk preferences on the companies but also suggests that firms tend to deliberately match new CEO recruits to their own risk preferences. Serfling justifies this argument with the detected negative relationship between CEO stock portfolio vega and CEO age: Older CEOs tend to have a lower vega. Combining this finding with the observation that firms with lower stock return variability hire older CEOs, Serfling concludes that less risky companies want to hire older CEOs to follow their low-risk strategies. It remains unclear, however, how well endogeneity can actually be controlled with an instrumental variable approach (2LSL regression) and the conclusion on the age-vega causality can thus be questioned. Serfling assumes that a low portfolio vega indicates that firms want older CEOs to take less risk. It might be, however, that older CEOs prefer lower incentive pay because of their shorter employment horizon, for example (Mehran, 1995).

Even though conclusions on causalities can be difficult to draw in correlative research, Serfling manages to find some relatively plausible evidence to support his hypothesis of firm-CEO matching. By using CEO successions, he finds that firms with a lower pre-succession volatility and greater diversification tend to hire older CEOs. This could imply that firms strive to match new CEO recruits to their risk preferences. The result remains robust after controlling the prior CEO's age and tenure, indicating that general firm preferences for CEO tenure do not explain the result.

Although Serfling finds evidence to support the hypothesis that firms attempt to match CEOs to their specific risk preferences, he also argues that this matching remains imperfect. Serfling examines how stock return volatility and leverage change when the successor CEO is either older or younger than the predecessor CEO. He finds that leverage increases by 10.5% and volatility by 7.1% when the new CEO is considerably (13-40 years) younger than the prior one.

In addition to examining the matching of CEO and firm risk preferences, Serfling studies whether and how capital markets react to CEO succession announcements when the CEO age changes. The motivation to this research question is that investors can be hypothesized to incorporate the firm risk in stock prices and a change in volatility due to a change in CEO age would thus cause a price shift. Serfling uses the same turnover sample as in the previous questions of age and risk preference matching and finds that when low-risk firms with low stock return volatility and greater diversification hire a much younger CEO, markets react negatively to the succession announcement. On the other hand, when a high-risk company recruits an older CEO, a corresponding market reaction is not observed in the sample. Based on this, Serfling concludes that when a risky firm hires a new CEO, other CEO characteristics than age play a more important role in evaluations.

In addition to the two studies that have directly examined the relationship between CEO age and firm risk, there is also more indirect evidence on the relationship. Altering the level of R&D expenditures is one means to influence firm risk since R&D investments are commonly seen as more risky than capital expenditures (Bhakat and Welch, 1995). Kothari et al. (2002) study the relationship between R&D expenditures and the standard deviation of future earnings and find that

the regression coefficient of R&D expenditures is approximately three times larger than the coefficient of capital expenditures. Also Shi (2002) finds that R&D investments are related to increased risk. Controlling other bond risk factors, the study suggest that there is a significant, positive correlation between R&D intensity and both bond default risk and risk premium. Dechow and Sloan (1991) discover that CEOs approaching retirement make fewer R&D investments, supporting the hypothesis of a negative relationship between CEO age and risk seeking.

Higher leverage is associated with an increased level of risk. Leverage can be divided into two categories: 1) operating leverage and 2) financial leverage. Operating leverage refers to the ratio of fixed costs to variable costs (Lev, 1974) and financial leverage to the ratio of outside debt to firm equity. Lev (1974) finds that higher operating leverage is associated with higher bond risk. Financial leverage, on the other hand, is linked to a higher risk due to the legal priority of debt providers over shareholders. Since it can be assumed that managers have influence on both types of leverage (and presumably especially on operating leverage), it can be suggested that managers can deliberately alter corporate riskiness by making decisions on leverage issues. In line with the agency theory, Berger et al. (1997) discover that CEOs' predisposition to issue the optimal amount of debt is reduced without strain from a disciplinary force (such as the board of directors). Regressed against corporate governance variables, leverage ratio decreases in conjunction with declined control. Researchers also find that leverage decreases with tenure, supporting the hypothesis that risk taking reduces with CEO age.

Another way to adjust firm risk is to engage in diversification. Diversification reduces risk since cash flows from different industries are less correlated than incomes from the same sector of business (May, 1995). Amihud and Lev (1981) examine the managerial motives for conglomerate mergers and hypothesize that managers engage in diversifying acquisitions in order to reduce their employment risk. Since they cannot diversify their human capital in their personal portfolios, they may seek to stabilize income flow through conglomerate mergers. CEOs might diversify also to ensure the survival of the firm in situations where shareholder wealth maximization would imply liquidation or shrinkage (Donaldson and Lorsch, 1983; cited in Morck et al., 1990b). If CEOs are afraid of losing their position in the firm due to inadequate results, they might try to move to new

business areas where they could improve their performance and be better than the best potential replacing manager (Shleifer and Vishny, 1989). Amihud and Lev (1981) find support for the proposed hypothesis in their empirical analysis. First of all, conglomerate mergers were more common in manager- than in owner-controlled companies. Secondly, owner-controlled firms were overall less diversified than manager-owned companies. These findings support the risk reduction hypothesis of the principal-agent model and other models explaining the divergence in managerial and shareholder risk attitudes. The study also emphasizes the role of conglomerate mergers as a means to reduce corporate riskiness. It can be noted, however, that the model suffers from a possible endogeneity problem, since it can be argued that owner-controlled firms might engage in fewer acquisitions only to retain control. This hypothesis is supported by the fact that owner-controlled firms typically have to use capital markets in order to diversify.

Amihud and Lev (1981) examine the effect of *opportunity* on diversifying. The more dispersed the shareholder base, the more *entrenched* the CEO is. With entrenchment, Amihud and Lev refer to managerial discretion guaranteed by loose monitoring. Instead of investigating the opportunity to act upon selfish preferences, May (1995) studies the role of managerial *motives* in the pursuance of risk reduction through diversification. As proxies for motives, he uses firm-specific tenure, ratio of personal wealth vested in the firm, expertise in certain assets and recent performance of the company. He finds that CEOs that have a higher tenure within the firm and have more wealth vested in firm equity tend to pursue a higher diversification level in acquisitions. Furthermore, he discovers that CEOs that have specific knowledge of certain technologies have a tendency to direct acquisitions in those fields. The findings are in line with the hypotheses that CEOs seek to decrease their human capital and portfolio risk through corporate risk adjustment. The conclusion that tenure has an impact on risk-taking is aligned with the assumption that human capital becomes more vested as career horizon shortens and that the increased employment risk encourages more senior CEOs to stabilize cash flows.

2.6. Pay-for-performance

Optimal executive compensation involves a component that ties manager's pay to firm performance (Jensen and Meckling, 1976). Pure fixed-pay compensation is not likely to incentivize

managers enough. In a perfect world, the principal would be able to fully observe the agent's activities and the investment opportunities a firm possesses. The agency problem could be resolved with mere contracting and monitoring. But since this is not the case in practice, agency theory predicts that shareholders will incentivize managers by introducing suitable compensation policies (Jensen and Murphy, 1990b) that tie pay to performance.

There are different means to offer managers value-increasing incentives: salary revisions, performance-tied bonuses, threat of dismissal and stock options (Jensen and Murphy, 1990b). Since the agency problem arises ultimately from the separation of ownership and control, also managerial stock ownership is an effective tool to align the interest of the different parties. Jensen and Murphy (1990b; pp. 139) state that "the most powerful link between shareholder wealth and executive wealth is direct stock ownership by the CEO". There are numerous findings in the academic literature on the positive effect of both stock grants and stock options on risk taking. Agrawal and Mandelker (1987) find that executive stock ownership encourages managers to make acquisitions and financing decisions that better align with shareholder preferences. Aggarwal and Samwick (2006) show that a combined measure of stock grants and options is positively related to managerial incentives and firm performance. Stock return volatility has been shown to increase after approving stock option schemes (DeFusco, et. al,1990) and option plans have been found to encourage managers to take on risky projects, instead of rejecting them (Hirschleifer and Suh, 1992).

Although there are findings on the positive effect of both stock ownership and stock options on risk taking, there is a fundamental difference between these two forms of incentive compensation. Whereas direct stock ownership exposes managers to both downside and upside risk, options offer managers only positive rewards (Holmström, 1999) and encourage them to engage in risk-seeking activities. If we hypothesize that managers are risk averse, it can be assumed that stock options are useful for aligning the incentives of managers and owners by encouraging executives to take more risk (Haugen and Senbet, 1981). Stock options incentivize risk taking since the value of an option increases along with the variability (i.e. risk) of stock price (Haugen and Senbet, 1981). All in all, it can be suggested that stock options are a more effective tool to incentivize managers than direct

stock ownership because they do not contain the downside risk that is characteristic for stock rewards.

Researchers have tried to explain the incentive effects of pay-for-performance by decomposing compensation based on the underlying utility functions. Guay (1999) strives to differentiate between two aspects of managerial compensation: delta and vega. Delta refers to the change in manager's wealth due to a change in stock price, whereas vega denotes the sensitivity of compensation to stock price variability. In mathematical terms, delta refers to the slope and vega to the convexity (differential coefficient) of the relationship between managerial wealth and stock price. According to Guay, an increased delta exposes the manager to a greater amount of risk but this increase in risk can be compensated for by raising vega that credits the manager for risk taking. These concepts can be linked to stock rewards and stock options. When the executive owns stocks of the company, his or her wealth changes linearly with stock price. Delta is then derived directly from the ratio of stock holdings to total compensation. On the other hand, when the executive holds options, both delta and vega can be calculated for the holdings. Delta is the wealth effect of stock price and vega the impact of stock volatility. Guay (1999) illustrates the distinction between the slope (delta) and convexity (vega) of incentive schemes by the following example:

At year end, two CEOs hold the following amounts of options and common stocks:

CEO$_1$: 94 400 shares worth $6,3 million and 102 500 stock options worth $3,9 million
CEO$_2$: 61100 shares worth $2,1 million and 539 900 stock options worth $4,3 million

Estimated by the Black and Scholes option-pricing formula, securities of both CEOs would increase in value by $600 000 as the stock price increases by 5 %. In other words, the *slope* of the wealth-performance relationship is the same for both executives. However, the impact of stock price volatility is significantly different for the two CEOs. CEO$_1$'s wealth would increase by only $55 000, while CEO$_2$ would gain $505 000 for a 5% climb in stock return volatility. The *convexity* of the pay-for-performance relationship is considerably different for the two CEOs. The one with fewer stocks and more options would be willing to take more risk than the other one.

Coles et al. (2006) find that a higher vega implies riskier policy choices, such as R&D intensity, less investment in property, plant and equipment, higher leverage and less diversification. These policies further relate to increased stock return volatility. Delta, on the other hand, does not cause riskier policy choices. Coles at el. examine the causalities between risk and compensation also in the opposite direction. They hypothesize that firms that prefer to implement riskier policy choices want to encourage their managers to seek risk by raising vega and by lowering delta (delta is assumed to discourage risk taking). In line with the hypotheses, the researchers conclude that vega depends positively on stock return volatility and riskier policy choices. On the contrary, less risky policy choices cause a higher delta.

Guay's (1999) and Low's (2009) empirical analyses also support the assumption that vega encourages risk-seeking better than delta. Guay finds that options increase the sensitivity of CEO wealth to equity risk and that this sensitivity is positively related to investment opportunities. The convexity of incentive schemes is further related to a higher stock return volatility. Delta, on the other hand, is not connected to an increased sensitivity of CEO wealth to equity risk or to better investment opportunities. Low discovers that managers decrease firm risk as a consequence of increased takeover protection and that this reduction is more significant in companies where CEO vega is low. Results of the impact of delta are mixed. Low concludes that vega is a more efficient tool for mitigating risk-related agency problems than delta. On the basis of these results, it seems reasonable to assume that the convexity of the incentive plan encourages managers to take risk and that the slope is of secondary interest. Vega incentivizes managers to take increasing amounts of risk but the findings on the impact of delta are mixed.

There is also conflicting evidence that suggests stock options having a negative effect on managerial risk taking. Carpenter (2000) and Ross (2004) argue that options can prohibit risk taking through making the manager's portfolio more sensitive to changes in firm stock price. Miller et. al (2002) illustrate the problem of incentive pay design by dividing the issue in two separate aspects. The first one is the degree of control the agent has over the actual outcomes and the second aspect has to do with the information on the agent's behavior. The more the agent can affect firm performance and the less the principal can monitor his or her behavior, the greater the pay-for-

performance sensitivity should be. Miller et al. hypothesize that firms with either low or very high return variability benefit less from high incentive pay schemes than companies with moderate risk. Since the amount of uncontrollable risk is greater for firms with high outcome spreads, high pay-for-performance sensitivity is likely to transfer an excessive amount of risk to the agent. On the other hand, low risk firms do not benefit from encouraging their managers to take large amounts of risk since this might jeopardize normal returns from a stable market domain. In line with the hypothesis, Miller et al. find that the relationship between the share of variable pay in CEO compensation package and the unsystematic risk is curvilinear (concave). A similar relationship could not be found for systematic risk which is understandable considering that this form of risk cannot be controlled by the agent. Furthermore, Aggarwal and Samwick (1999) discover a negative relationship between the variance of firm stock returns and the executive pay-for-performance sensitivity. The detected relationship is again attributed to the uncontrollable risk transferred to the agent.

Some academics have discussed the optimal level of pay-for performance sensitivity in different ages. According to Gibbons and Murphy (1992), the total incentives offered in the compensation contract consist of both implicit and explicit incentives, the former referring to incentives introduced by career concerns and the latter to the motivational effects of the compensation contract. Since the implicit concerns are weaker for older managers, their compensation should have a higher pay-for-performance elasticity – in other words, they should be more strongly incentivized by the compensation plan. Younger executives' pay, on the other hand, should be less performance-related. According to Gibbons and Murphy, the optimal level of pay-for-performance increases as the variability (risk) of the output decreases. This is due to the trade-off between two goals of on the one hand proving incentives and on the other hand sharing risk with the risk-aversive CEO: As the risk in the output diminishes, the CEO has to bear less uncontrollable risk in his or her pay-for-performance compensation and is thus better motivated to align actions with shareholder incentives. Since the uncertainty about managerial ability is higher for younger CEOs and since this uncertainty is incorporated in the variability of shareholder wealth, the optimal level of pay-for-performance is lower for younger CEOs. Gibbons and Murphy find support for the theoretical prediction that older CEOs have a higher pay-for-performance elasticity.

Contrary to the findings of Gibbons and Murphy (1992), Matta and Beamish (2008) question the optimality of stock ownership and option-based incentive contracts as CEOs approach retirement. According to them, a short career horizon distorts the motivational effect of these forms of compensation. First of all, investors assume that risk is smoothed as the investment horizon lengthens and tend to act risk-aversively with short-term investments. Secondly, the amount of uncontrollable risk in CEO wealth position rises after retirement since the retiring CEO does not have any control over the actions taken after his or her retirement. Asset preservation concerns may further exacerbate the undesirable incentive effects of senior CEOs' compensation. As CEOs move towards retirement, their focus may shift from asset accumulation to asset preservation, implying greater risk aversion, and the motivational effect of volatile stock compensation is mitigated. Matta and Beamish even argue that stock holdings and options discourage retiring CEOs from making strategic, risky investments and can thus work against their original purpose.

2.7. CEO succession and volatility

Although there are implications in the literature of the impact of age on firm risk, it has to be noted that the CEO succession event itself can trigger changes in volatility. The evidence on the subject is surprisingly vague, however. Peters and Wagner (2014) examine the preconditions of CEO successions and find that forced turnovers are more likely in companies with more uncertain industry and firm-specific conditions. They use three proxies to measure these conditions, one being stock return volatility. Turnovers are more likely in companies where firm-specific and industry-specific volatilities are higher.

Clayton et al. (2005) study the impact of CEO succession on volatility. They hypothesize that volatility increases after turnover and assume that the mechanism behind the relationship is two-fold. Strategy-hypothesis suggests that uncertainty about the future strategic course of action increases as CEO changes, and this risk should cause a climb in volatility. Ability-hypothesis resembles strategy-hypothesis but attributes the increased uncertainty to the unawareness of the manager's competence to run the company. The researchers find that volatility increases after both voluntary and forced turnovers and that the climb is more substantial for outside than inside successions. Forced turnovers lead to a bigger shift in volatility than voluntary successions. The

findings on the effects of the type of succession are presumable in the light of the hypotheses. When the new CEO is hired from within the company, the uncertainty about her ability is likely to be less substantial than that of an outside recruit. Because an insider is more familiar with company strategy and presumably also more entrenched in the firm values and visions, investors are likely to be less concerned about the strategic choices made. Furthermore, a forced CEO turnover could signal pursuance of strategic change and might lead to a realization of the strategy hypothesis. Also Intintoli (2013) finds that forced turnovers are related to an increase in stock return volatility.

Cheung and Jackson (2013) investigate the effect of CEO turnover announcements on stock return volatility. Unlike Clayton et al. (2005) and Intintoli (2013) who study the effects on longer-term volatility, they strive to examine how announcements are related to shorter-term variability in stock returns. Whereas long-term volatility reflects the underlying economic conditions of the firm, a short-term measure can be employed to capture the information effect of the announcement. It is hypothesized that CEO turnover announcements increase short-term volatility as investors revise their expectations of future firm performance. The authors find that announcements are related to a climb in volatility and that this increase is larger for forced than voluntary turnovers.

2.8. Summarizing the findings and hypothesis construction

The below table summarizes the results of the literature review. Altogether, literature seems to support the hypothesis that age and risk taking are negatively related to each other: The older the individual, the less eager he or she is to seek risk. 18/23 of the presented papers conclude that age (or tenure) is negatively related to risk seeking whereas only five studies suggest the opposite. Studies on individuals' (both managers' and non-managers') decision-making offer strong support to this prediction: All the discussed research papers endorse this conclusion. Investment behavior research has reached conflicting results on the issue but the majority of the presented studies still support the hypothesis of a negative relationship. Theoretical models also predict contradicting outcomes. Since the results of these studies are based on varying assumptions that are not necessarily supported by empirical evidence, the reliability of these results can be questioned, however. All the discussed empirical studies of CEO age (or tenure) and firm risk offer support for the presumption of a negative relationship. It has to be noted, however, that the relationship

between CEO age and corporate risk is possibly at least partly driven by CEO-firm matching so all of the observed correlation cannot be automatically attributed to CEOs' personal risk preferences and their effect on corporate policies. In this respect, the findings on individuals' personal risk seeking and on the consistency between CEO personal and corporate risk behavior offer a more solid basis for the assumption that CEOs adjust firm risk.

TABLE 1. SUMMARY OF THE RELEVANT LITERATURE

Direction of relationship	Personal		Career-specific	
	Decision-making	Investment behavior	Theoretical predictions	Empirical evidence
Negative	Wallach&Kogan 1961	Baker&Haslem 1974	Matta&Beamish 2008	Elsaid&Ursel 2012
	Vroom&Pahl 1971	Morin&Suarez 1983	Gibbons&Murphy 1992	Serfling 2014
	Taylor 1975	Bakshi&Chen 1994	May 1995	Berger et. al 1997
	Prendergast&Stole 1996	Hawley&Fuji 1993-94		Dechow&Sloan 1991
	Child 1974	Yao et. al 2011		May 1995
Positive		Wang&Hanna 1997	Holmström 1999	
		Weagley&Gannon 1991	Zwiebel 1995	
		Riley&Chow 1992		

Based on the above summary of the relevant literature, I construct the following main hypotheses for this thesis:

H1: Age is negatively related to stock return volatility.

I also strive to examine how CEO succession itself affects the volatility. The relevant literature suggest that CEO turnover increases volatility. Uncertainty about the future firm strategy and the

ability of the new CEO can be assumed to increase post-succession volatility. Thus, the second hypothesis is:

H2: CEO change is positively related to stock return volatility.

The third explored issue is the interaction effect between CEO change and age. In other words, I try to find out if the relationship between age and stock return volatility is different before than after the CEO turnovers. Since I do not control the effect of tenure or career horizon in this thesis, it could be presumed that the interaction effect is positive. This would mean that the relationship between age and volatility is weaker after the successions than before them. This hypothesis is supported by the findings on legacy conservation, decision horizon and career concerns. CEOs that have a short career horizon can be assumed to be more concerned about legacy issues and about the incapability to undo regretted actions and hypothesized to avoid risks. Short-tenured CEOs, on the other hand, are likely to avoid negative inferences due to the uncertainty about their talent. The average CEO age can be assumed to decline after the successions, so older CEOs are likely to be further away from retirement in the post-succession than in the pre-turnover subsample. Thus, it can be assumed that older post-succession CEOs are less concerned about their legacies and short decision horizons and hypothesized to seek more risk than pre-succession senior CEOs. Furthermore, young post-succession CEOs can be presumed to be more concerned about the perceived value of their human capital and hypothesized to take less risk than young pre-succession CEOs. All in all, it seems reasonable to suggest that the interaction between CEO change and age is positive. The third hypothesis is:

H3: CEO change moderates the relationship between age and stock return volatility.

In addition to these main hypotheses, I assume the following:

H4: Vega is positively related to stock return volatility.

H5: Delta is positively related to stock return volatility.

H6: CEO age is related to market to book ratio.

Market-to-book ratio is used as a proxy for firm's future growth prospects (Cheng and Zhao, 2006). I do not presume any direction to the last hypothesis since it is a side note to the main scope of this thesis and I do not have extensive literature to support any detailed assumptions of the relationship. It is possible that investors would increase their positive expectations of firms' future prospects as younger, more dynamic CEOs are appointed. On the other hand, they can be assumed to be more uncertain about the talent of a young CEO than that of a more senior one. This uncertainty might weaken evaluations of the growth potential.

3. Data and method

I collected my observations from the ExecuComp database that contains U.S. managerial compensation data from fiscal years 1992 to present. The database contains information on over 37 000 executives of more than 3 000 companies. The firms are active, inactive, current and previous members of the Standard and Poor's 1500 Index. Total and detailed information is offered on cash compensation, bonuses, stock and option awards, exercises and outstanding previous awards. (www.capitaliq.com/home/what-we-offer/information-you-need/qualitative-data/execucomp.aspx) S&P1500 is a composite index of three smaller indices: S&P 500®, S&P MidCap 400®, and S&P SmallCap 600®. It covers approximately 90% of the market capitalization in the United States. S&P 500® comprises largest U.S. companies from various leading industries of the economy, with market capital of $5,3 billion or greater. S&P MidCap 400® companies have a market capital between $1,4 and $5,9 billion and S&P SmallCap 600® companies a market capital between $400 million and $1,8 billion. The indices do not overlap so they can be used to build a composite index. (https://us.spindices.com/ indices/equity/sp-composite-1500) Altogether, my data consists of relatively large and large exchange-listed companies from various fields of the U.S. economy. I excluded financial institutions (standard industry classification codes 6000-6999) and utilities (SIC codes 4900-4999) (Serfling, 2014).

I use a matched-pair design that should automatically control fixed firm effects (i.e. firm-specific factors that can be hypothesized to impact stock return volatility). Serfling (2014) uses following firm-specific control variables in his study: book assets (the book value of assets), market-to-book (the market value of the firm divided by the book value of assets), return on assets (the income before extraordinary items divided by the book value of assets), cash holdings (the book value of cash and short-term investments divided by the book value of assets), sales growth (the percentage increase in sales), blockholder (a dummy variable to indicate if the firm has an institutional investor of minimum 10% ownership), stock return (a firm's annual stock return) and firm age. Since all these variables are firm-specific, it can be assumed that they do not vary significantly in the three-year time frame of my sample, and I can thus exclude them from my analysis. The only control variables I use are delta and vega that account for the possible changes in CEO compensation within the company. These controls are included since they are manager-specific and can thus be assumed to change along CEO successions. In addition to delta and vega, Serfling (2014) uses tenure as a CEO-specific variable to separate the effect of pure age from the impact of tenure. Since my research design uses a CEO succession structure, I cannot use this control (all successor CEOs have tenure of two years). Another CEO-specific variable that has been shown to affect corporate risk is CEO gender (Elsaid and Ursel, 2011). I excluded this variable from my analysis since the sample involved only 26 female observations and the dummy variable for gender was not statistically significant. It was not possible to account for the effect of gender within this research setting.

I chose my observations from fiscal years t-1 and t+2, t being the year of CEO succession. I used this design because I wanted to choose the latest possible period for the predecessor CEO and a sufficiently late period for the new one without constraining the data excessively. I limited my observations to chief executive officers that have a minimum tenure of three years in order to exclude CEOs that probably have not had time to significantly alter firm practices. The parameter "age" was provided in present terms and transformed to correspond to CEO age in the fiscal year in question. Compensation data was derived from fiscal years t-1 and t since information from year t+2 was not available. This design is reasonable since it can be assumed that compensation changes take place synchronously with CEO succession.

31

Even though there is mixed evidence in the literature on the effect of delta on incentives, I chose to include it in the model. E.g. Coles et al. (2006) recommend this kind of an approach and argue that both measures have been shown to impact on incentives to an extent that justifies the use of both variables. Prior studies have used other proxies to account for compensation, such as the number or the value of options and stock grants. These measures are, however, more biased and less theory-based than vega and delta (Core and Guay, 2002). A readily available dataset with deltas and vegas was provided online by Core and Guay (2002) and the method for computing the figures was first introduced by Coles et al. (2006). Delta is the dollar change in wealth associated with a 1% change in the firm's stock price and vega is the dollar change in wealth associated with a 0,01 change in the standard deviation of the firm's returns. Both figures are in thousands of dollars. (Coles et al., 2006)

Daily stock volatility information is derived from Center for Research in Security Prices database. Daily volatility is calculated using the following formulas (http://financetrain.com/how-to-calculate-volatility-in-excel/):

$$Day\text{-}to\text{-}day\ change\ in\ stock\ price = x = \left(\frac{Close\ price\ at\ day\ t}{Close\ price\ at\ day\ t-1} - 1 \right) \qquad \text{(1a)}$$

$$Daily\ stock\ return\ volatility = \sqrt{\frac{\sum (x - \bar{x})^2}{n-1}} \qquad \text{(1b)}$$

Daily volatility is further transformed into an annual form with the following formula (http://financetrain.com/how-to-calculate-volatility-in-excel/):

$$Annualized\ stock\ return\ volatility = Daily\ stock\ return\ volatiliy \times \sqrt{252} \qquad \text{(2)}$$

The data for market-to-book ratios is collected from COMPUSTAT database and the ratio is computed following Cassell et al. (2012):

$$\frac{Market\ value\ of\ equity}{Book\ value\ of\ assets} \qquad \text{(3a)}$$

using Compustat items

$$\frac{CSHO \times PRCC\_F}{CEQ} \tag{3b}$$

where

  CSHO   = Number of common shares outstanding
  PRCC_F = Price close at the end of fiscal year
  CEQ   = Common/ordinary equity.

The data was analyzed with IBM SPSS Statistics using descriptive statistics, paired samples t-tests, correlation and regression analysis. The following regression equations were employed to examine the relationship between age and volatility:

$$Log\_vol = \beta1 \times log\_age + \beta2 \times log\_delta + \beta3 \times log\_vega + \beta4 \times V + e \tag{4}$$

where

Log_vol	=	Natural logarithm of annualized daily stock return volatility
Log_age	=	Natural logarithm of CEO age at year t-1 or t+2
Log_delta	=	Natural logarithm of the dollar change in wealth associated with a 1% change in the firm's stock price
Log_vega	=	Natural logarithm of the dollar change in wealth associated with a 0,01 change in the standard deviation of the firm's stock returns
V	=	Vector for year dummies 1992-2009
e	=	Error term

$$Log\_vol = \beta1 \times log\_age + \beta2 \times CHANGE + \beta3 \times CHANGE * log\_age + \beta4 \times$$
$$log\_delta + \beta5 \times log\_vega + \beta6 \times V + e \tag{5}$$

where

CHANGE	=	A dummy variable for CEO succession (0 for predecessor and 1 for successor CEOs)
CHANGE*log_age	=	Product of CEO succession dummy and natural logarithm of CEO age

$$Log\_vol = \beta 1 \times log\_age + \beta 2 \times CHANGE + \beta 3 \times DIRECTION + \beta 4 \times log\_delta + \beta 5 \times log\_vega + \beta 6 \times V + e \qquad (6)$$

where

DIRECTION	=	A dummy variable for the direction of CEO age change (0 for younger CEOs, 1 for older CEOs)

The first regression equation is employed to examine the relationship between volatility and plain age, without controlling the possible effect of CEO change. The second regression incorporates a dummy variable that accounts for the effect of CEO succession and an interaction variable to estimate the possible mediator or moderator effect of CEO change on the effect of age. The last model is employed in order to examine whether the direction in which the CEO age changes plays a role.

Year dummies are employed in the purpose of avoiding autocorrelation (Langbein and Felbinger, 2006; pp. 174). Autocorrelation refers to a situation where the regression error term picks up the influence of time-related variance in a time-series data (Dougherty, 2002; pp. 337) Year 2010 is used as reference group and excluded from the model in order to avoid the dummy variable trap. A dummy variable trap emerges when the reference group (in this case year 2010) is included in the model as a dummy. The interpretation of the regression coefficients becomes impossible in a dummy variable trap situation. The coefficient of a dummy variable can be interpreted as the change in the model intercept from the basic level which is the level of the reference group. In a dummy variable trap situation, there is not a reference group and the interpretation collapses. The situation also causes a case of exact multicollinearity which makes it impossible to calculate the regression coefficients at all. (Dougherty, 2002; pp. 180)

The initial data contains 2224 observations. All observations had values for volatility and age but some lacked vega and delta values (121 missing deltas and 35 missing vegas). I used this initial sample to run descriptive statistics, paired t-tests (for age and volatility) and correlations. IBM SPSS Statistics automatically erases observations with missing data on the analyzed variables.

Before running the regressions, I eliminated all CEO succession pairs that had missing delta or vega values in order to maintain the paired sample design (without this procedure, SPSS would have eliminated only those individual CEO observations that have missing values).

4. Results

In the following, I will present the results of my empirical analysis. Results from descriptive statistics, paired t-tests, correlations and regressions are reported.

4.1 Descriptive statistics

As can be seen from the below table, all the observations had values for volatility and age. 121 observations lacked the delta value and 35 observations the vega value. Volatilities range from 0,007 to 0,151 and have a mean of 0,026. The youngest CEO in the sample was 31 and the oldest one 86 years old, average age being approximately 56 years. Some of the firms in the sample have zero deltas and vegas. Only five observations have zero deltas. This reflects the importance of incentive compensation in large, exchange-listed corporations. On the other hand, 137 observations have a zero vega which indicates that not all firms in the sample use convex incentive schemes. The maximum delta is $559 million for the CEO of Microsoft Corporation and the maximum vega around $4 million. Means of delta and vega are $931 thousand and $141 thousand, respectively. In other words, when stock price increases by one percent, CEO wealth increases by around $931 000, on average. When stock return volatility increases by a percent, CEO wealth rises by around $141 000, on average.

TABLE 2. DESCRIPTIVE STATISTICS

	N	Minimum	Maximum	Mean	Std. Deviation
Volatility	2224	0,007	0,151	0,026	0,015
Age	2224	31	86	56,1	7,5
Delta	2103	0,000	558974,191	930,841	12884,108
Vega	2189	0,000	3984,761	141,893	280,527

In the time frame of t-1 to t+2, the average age of the CEO reduces by approximately 6,3 years, implying that the new CEO is on average 9,3 years younger than the new one. The age of the CEO drops in 848 successions and rises in 266 successions, respectively. When the change happens from a younger CEO to an older one, the average age is 51,9 at time t-1 and 56,9 at time t+2. On the other hand, when the change happens in the opposite direction, the average ages are 61,5 and 51,7 years. It can be seen that CEOs of the S&P1500 companies are fairly old. When a new CEO is appointed, he or she is 50,7 years old, on average.

FIGURE 1. HISTOGRAM OF STOCK RETURN VOLATILITY
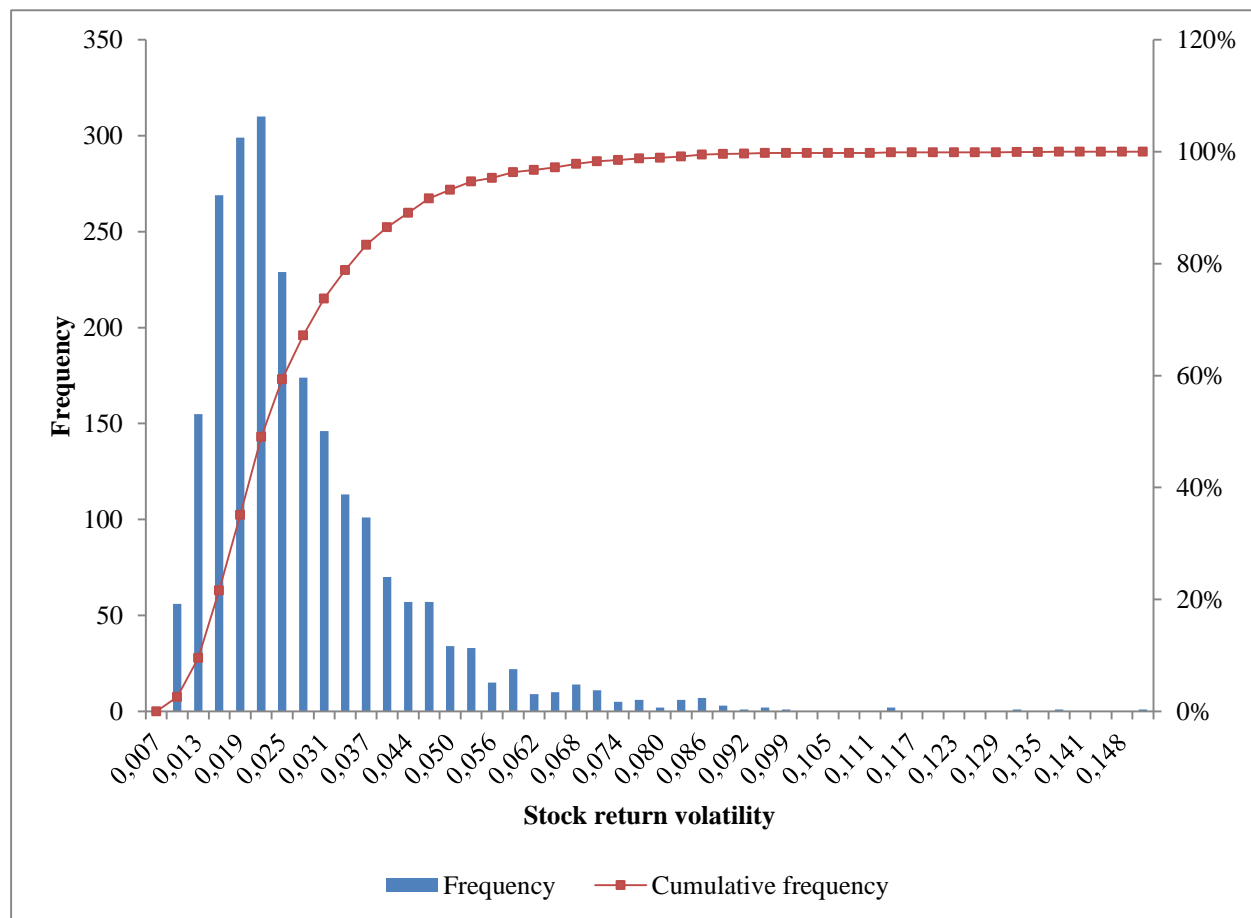
As can be seen from the above histogram of stock return volatility, relatively small volatilities are most common in the sample, median value of annual volatility being approximately 2,2%. Only

around 10% of the observations have a stock return volatility of 4,5% or higher and only 0,2% a volatility higher than 10%. The distribution is positively skew.

FIGURE 2. HISTOGRAM OF AGE
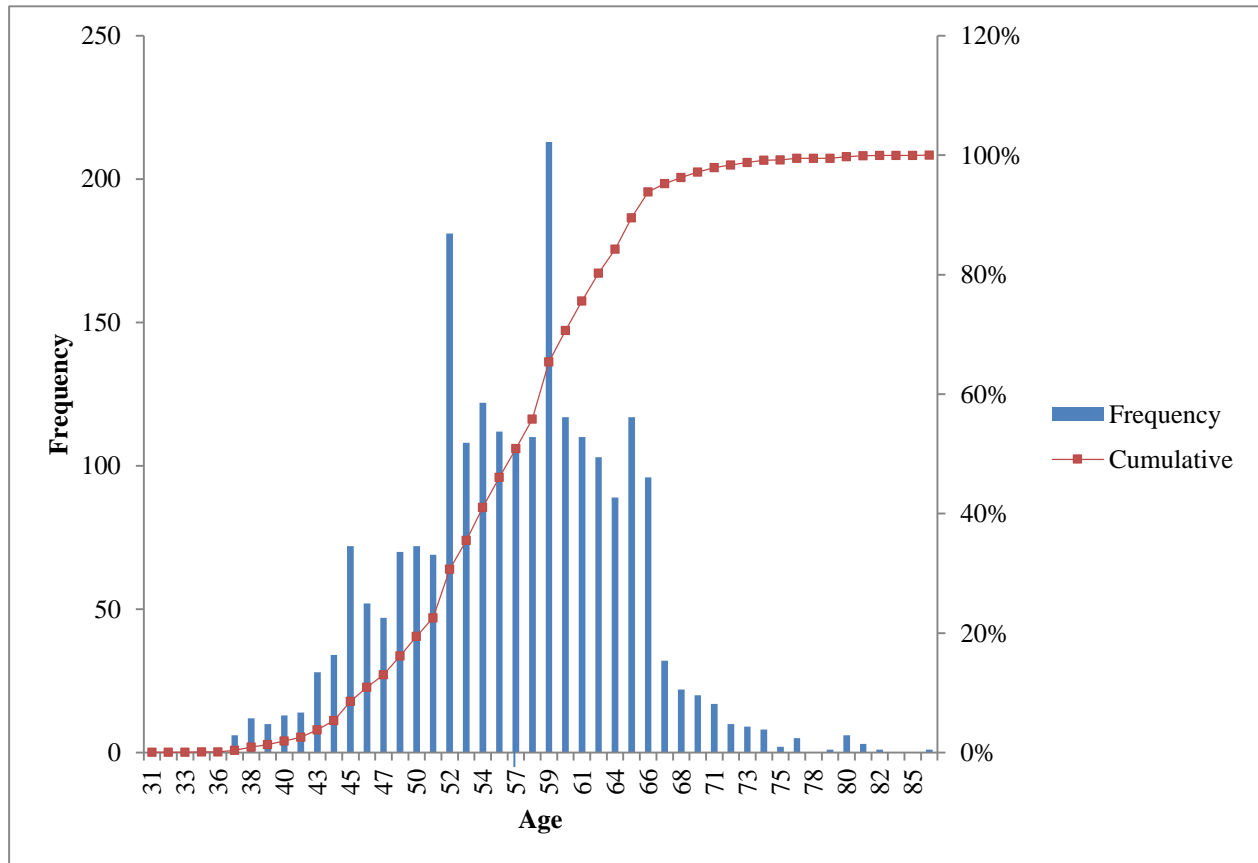
The median of age is 56 years. The distribution of age seems to be fairly normally distributed. The retirement age in 1992-2010 has varied between 65 (for people born before 1938) and 66 (for people born in 1943-1944) (http://www.ssa.gov/retirement/ageincrease.htm). Approximately 6,2% of the sample CEOs have continued at office after the official retirement age. Only 19,4% of the sample CEOs are younger than 50 years. About 30 percent of the CEOs are older than 60.

4.2 Comparing means

From the below table, one can see how the means of the variables change along with CEO successions. The average volatility rises from 0,025 to 0,028, the average age drops from 59,2 to 52,9, the average vega reduces from 151,8 to 132,0 and the average delta from 134,577 to 517,077. These results give a hint about the possible interrelations between the variables. As CEO changes, the average age drops but the average stock return volatility increases. Based on this, it could be hypothesized that there is a negative relationship between age and volatility. These results also suggest that younger CEOs probably have a lower pay-for-performance sensitivity than more senior ones: Both the average vega and the average delta are lower for the post-succession sample than for the pre-succession sample. Paired samples t-tests of the independent variables (age, vega and delta) confirm that the pre vs. post succession differences in the variable means are statistically significant. The means differ at the 0,05 significance level for delta and vega and at the 0,001 level for age. Consequently, it can be concluded that age, vega and delta all decline after the successions, on average.

TABLE 3. DESCRIPTIVE STATISTICS AND PAIRED SAMPLES T-TEST RESULTS FOR PRE-AND POST-SUCCESSION SUBSAMPLES

	N	Minimum	Maximum	Mean	Std. Deviation	T-test p-value
Volatility before	1112	0,007	0,137	0,025	0,014	**0,000**
Volatility after	1112	0,007	0,151	0,028	0,016	
Age before	1112	36	86	59,232	7,241	**0,000**
Age after	1112	31	74	52,927	6,242	
Vega before	1094	0	3984,76	151,805	318,776	**0,032**
Vega after	1095	0	3024,22	131,99	235,943	
Delta before	1049	0	558974	1346,58	17397,3	**0,030**
Delta after	1054	0	174744	517,077	5458,61	

I compared volatility means with paired samples t-tests and conducted comparisons between three different pairs of groups. The pair number one consists of CEO succession pairs that underwent a change from an older to a younger CEO. The pair number 2 involves pairs that experienced a change in the opposite direction. The pair number three is comprised of all the observations, grouped on the basis of whether the CEO is the older or the younger counterpart in the succession. As can be seen from the below table, pairs 1 and 3 have statistically significantly differing means. The insignificance of the pair 2 test is probably due to the limited amount of observations (only 266 observations, i.e. 133 per group), yet also this test is significant at the 90 percent confidence interval. In the pair number one, the volatility of stock returns is statistically significantly higher for younger CEOs than for their older predecessors/successors. The mean volatility is 0,0265 for the younger and 0,0243 for the older CEOs. For the pair number two, the pre-turnover volatility is lower than that after the successions (0,0290 vs. 0,0309). This finding conflicts with the hypothesis that younger CEOs increase corporate risk (predecessors are younger than their successors in this test pair). As was already mentioned, however, this result is significant only at the 90 percent confidence interval and the detected difference in the means can thus be assumed to be zero. For the pair number three, the t-test indicates a relationship that is in line with the hypothesis of age and volatility. Predecessor and successor CEOs that are younger than their matched pairs have a higher average volatility. The average volatility is 0,0271 for the younger and 0,0259 for the older observations.

TABLE 4. PAIRED SAMPLES T-STATISTICS FOR VOLATILITIES

		Mean	Difference	Sig. (2-tailed)	N	Std. Error Mean
Pair 1	Volatility before	0,024	-0,002	**0,000**	847	0,000
	Volatility after	0,027			847	0,001
Pair 2	Volatility before	0,029	-0,002	0,085	265	0,001
	Volatility after	0,031			265	0,001
Pair 3	Volatility for younger CEO	0,026	-0,001	**0,011**	1112	0,000
	Volatility for older CEO	0,027			1112	0,001

4.3 Correlations

I use Pearson's correlation coefficient to evaluate the relationship between volatility and age since both of the variables are measured in the ratio scale. As can be seen from the below table, the correlation coefficient between age and volatility gets the value -0,203 and is significant at the 0,001 significance level. This result implies that there probably is a linear relationship between age and stock volatility and that this relationship is negative. The finding is in line with the hypothesis 1: Older the CEO, less risky the company.

TABLE 5. CORRELATIONS

		Volatility	Age	Delta	Vega
Volatility	Pearson Correlation		**-0,203**[**]	-0,014	**-0,153**[**]
Age	Pearson Correlation	**-0,203**[**]		-0,036	**0,042**[*]
Delta	Pearson Correlation	-0,014	-0,036		0,030
Vega	Pearson Correlation	**-0,153**[**]	**0,042**[*]	0,030	

There are also other statistically significant correlations between the variables. Age is statistically significantly and positively correlated with vega, indicating that older CEOs' wealth is more tightly linked to stock return volatility than younger CEOs' firm-related wealth. Incentive-vice, this could imply higher risk-seeking of older CEOs. Nevertheless, volatility itself is negatively related to vega. This finding contradicts with the assumptions of the agency theory and the findings on the effect of vega on firm risk and go against the hypothesis 4. In principle, the surprising result could result from the research design employed. Since the observations are from around CEO successions, it might be possible that the main independent variable, age, accounted for the negative correlation. Age is positively correlated with vega and negatively correlated with volatility. As CEO changes, his average age and vega both decline (see paired samples t-tests). On the other hand, the average stock return volatility declines after the CEO successions. Thus, it could be possible that the correlation between vega and volatility is caused by a third factor, in this case,

age. Furthermore, if the detected correlation between age and vega accounted for the relationship between volatility and vega, a problem of multicollinearity would be present in the regression analysis. A model suffers from multicollinearity when the independent variables are highly correlated with each other. Multicollinearity makes it hard to detect the individual effects of the independent variables (Dougherty, 2002; pp. 130). Since the observed correlations are moderate, however, a problem of multicollinearity is not likely to arise. The surprising finding on the correlation between volatility and vega is more probably caused by the time structure of the data. Since incentive schemes can be assumed to affect risk-taking with a lag, it might be that firms with lower risk have introduced heavier incentive schemes to encourage their CEOs to take more risk but that the actual impact of the pay schemes takes place only later on. It is also possible, however, that higher risk companies tend to choose lower levels of pay-for-performance sensitivities to protect their managers from bearing excessive amounts of uncontrollable risk.

Delta is not statistically significantly correlated with any of the other variables. With regard to age and vega, this indicates that delta is not likely to cause problems of multicollinearity in the regressions. At the same time, it might indicate that delta is not a meaningful predictor of stock return volatility. It has to be remembered, however, that the t-test of the correlation coefficient tests the null hypothesis of a non-linear relationship. Thus, an insignificant test result only implies that the null hypothesis stays in force and that the relationship cannot be argued to be linear. A non-linear association between the variables can still exist.

TABLE 6. CORRELATIONS BETWEEN THE LOGARITHMIC VARIABLES

		Log_vol	Log_age	Log_delta	Log_vega
Log_vol	Pearson Correlation		-0,213[**]	-0,242[**]	-0,237[**]
Log_age	Pearson Correlation	-0,213[**]		0,098[**]	-0,025
Log_delta	Pearson Correlation	-0,242[**]	0,098[**]		0,570[**]
Log_vega	Pearson Correlation	-0,237[**]	-0,025	0,570[**]	

As can be seen from the above table, the correlations between the natural logarithms of the dependent and independent variables are stronger than the correlations between the non-logarithmic volatility, age, delta and vega figures. Also the correlation between delta and volatility is significant when using logarithmic variables. The relationship is negative, further enforcing the hypothesis of a negative relationship between CEO age and pay-for-performance sensitivity. The correlation between delta and age is also negative, indicating that incentive pay is a declining function of CEO age. Since all the correlations between the dependent and the independent variables are stronger when using logarithmic transformations, it seems reasonable to use a log-log formula in the following regression analysis.

4.4 Regressions

The correlation coefficient might indicate that there is an association between two variables but cannot tell anything more specific about the type of the relationship (Dougherty, 2002; pp. 48). In this thesis, I use linear multiple regression. Linear regression is justified since correlation analysis indicates a linear relationship between the logarithmized variables. A multiple regression should be used when it can be assumed that several different factors are related to the dependent variable of interest. A linear regression coefficient estimates the amount of change in the dependent variable when the independent variable changes by one measurement unit and is thus dependent on the measure in use (Pulkkinen and Holopainen, 2008; pp. 275). In the following models, variables volatility, age, delta and vega are transformed into a logarithmic form. Transformation of the variables changes the interpretation of the regression coefficients (Dougherty, 2002; pp. 153). The relationship between the dependent variable stock return volatility and the independent variables age, CEO succession and the direction of age change is examined.

4.4.1 Effect of age on volatility

My first regression models the relationship between age and stock return volatility (hypothesis 1). I regress volatility against the variables age, delta, vega and year dummies:

Log_vol =β₁*log_age + β₂*log_delta + β₃*log_vega + β₃*V + e,

The R squared measures the model's goodness of fit (Dougherty, 2002; pp. 65). It is the "proportion of variance explained by the regression line" (Dougherty, 2002; pp. 66). As can be seen from the below table, the R squared of this model is 0,345 and the adjusted R squared is 0,338. The adjusted R squared is often considered to better reflect the amount of variance explained by the model than the ordinary R squared. Whereas the R squared improves every time a new variable is added to the regression, the adjusted R squared penalizes for increasing the amount of explanatory variables in the model and does not automatically improve. However, it can be mathematically shown that the adjusted R squared increases when the t-statistics of the new variable is 1 or greater and thus, a rise in the adjusted R squared does not necessarily mean that the coefficient of the added variable differs significantly from 0. Hence, adjusted R squared does not necessarily measure goodness of fit better than the regular R squared. (Dougherty, 2002; pp. 147)

The F test is used to test the joint explanatory power of a multiple regression equation (Dougherty, 2002; pp. 140). It is a test for the null hypothesis that the R squared diverges from 0 by accident (Dougherty, 2002; pp. 110) The F statistics of the here employed model is significant at the 99,9 % confidence interval, indicating that the joint explanatory power of the dependent variables is statistically significant (see the below table).

TABLE 8. REGRESSION COEFFICIENTS AND COLLINEARITY STATISTICS FOR THE REGRESSION MODEL 1

	Unstandardized Coefficients		Standardized Coefficients	Collinearity Statistics
	B	Std. Error	Beta	VIF
constant	**0,103***	0,008		
log_age	**-0,017***	0,002	**-0,166***	1,066
log_delta	**-0,001***	0,000	**-0,093***	1,563
log_vega	**-0,002***	0,000	**-0,214***	1,597
1992	**-0,007***	0,007	**-0,019***	1,039
1993	-0,003	0,002	-0,037	1,533
1994	**-0,004***	0,002	**-0,055***	1,628
1995	-0,004	0,002	-0,044	1,599
1996	**-0,004***	0,002	**-0,054***	1,928
1997	-0,001	0,002	-0,023	2,176
1998	**0,007***	0,002	**0,121***	2,199
1999	**0,009***	0,002	**0,143***	2,130
2000	**0,015***	0,002	**0,264***	2,225
2001	**0,011***	0,002	**0,203***	2,274
2002	**0,012***	0,002	**0,209***	2,253
2003	**0,003***	0,002	**0,057***	2,180
2004	0,000	0,001	-0,001	2,547
2005	-0,002	0,002	-0,038	2,235
2006	**-0,003***	0,002	**-0,053***	2,180
2007	-0,001	0,001	-0,019	2,754
2008	**0,019***	0,002	**0,247***	1,675
2009	**0,010***	0,002	**0,127***	1,633
R squared	0,345			
Adj. R squared	0,338			
F sig.	**0,000**			

As can be seen from the above table, age, vega, delta and year dummies 1998-2002 as well as 2008-2009 are statistically extremely significant. Age, vega and delta have negative coefficients whereas

the year dummies 1998-2002 and 2008-2009 have a positive relationship with volatility. These results imply that CEO age is a meaningful factor predicting firm riskiness. Older CEOs manage less risky firms, even when controlling their risk-taking incentives produced by pay-for-performance. Coefficients of vega and delta are in line with the above-mentioned correlations. Both measures are negatively related to stock return volatility. These results again contradict with hypotheses 4 and 5.

The significance of the above mentioned year dummies shows that certain years, volatility has been larger than the reference year 2010. Both of the time frames 1998-2002 and 2008-2009 have been economically turbulent periods so it is not surprising that corporate risk has increased. The burst of the IT bubble took place in early 2000 (Cuñado et al, 2009) and the WTC terrorist attacks happened in 2001. Furthermore, the global financial crisis began in fall 2008.

Interpretation of the regression coefficients in a log-log-regression is the following: When the independent variable changes by one percent, the dependent variable can be expected to change by β percent (Dougherty, 2002; pp. 153). Thus, it can be seen that when CEO age changes by one percent, volatility drops by 0,017 percent. Furthermore, volatility drops by 0,001 when vega and 0,002 percent when delta changes by one percent. Thus, it can be seen that the detected changes in the stock return volatility due to changes in the independent variables are relatively small.

VIF value is a measure of multicollinearity. The VIF values of all the independent variables are smaller than 2,3. Probably the most common upper bound for an acceptable VIF value is 10 (Hair et al., 1995); some suggest that the critical level is 5 (Pulkkinen and Holopainen, 2008; pp. 279). Either way, it can be argued that this model does not suffer from the problem of multicollinearity.

TABLE 9. RELATIVE IMPORTANCE OF THE INDEPENDENT VARIABLES

Variable	Stand. Coefficient	Absolute value
2000	0,264	0,264
2008	0,247	0,247
log_vega	-0,214	0,214
2002	0,209	0,209
2001	0,203	0,203
log_age	-0,166	0,166
1999	0,143	0,143
2009	0,127	0,127
1998	0,121	0,121
log_delta	-0,093	0,093
2003	0,057	0,057
1994	-0,055	0,055
1996	-0,054	0,054
2006	-0,053	0,053

By looking at the absolute values of the standardized regression coefficients, one can compare the relative importance of the different independent variables in the regression equation (Schielzeth, 2010). Year dummies 2000 and 2008 are the most important, followed by vega, year 2002 and year 2001. Age is the sixth most important variable, and more important than delta. These results show that market turbulences account for a large amount of the variance discovered in the model: Years of the bursts of the IT bubble and the financial crisis are especially important predictors of volatility. Furthermore, vega has more predictive power than age and thus, it can be concluded that

it is more tightly linked to stock return volatility than age. This is understandable, since the whole purpose of the pay-for-performance is to align managerial effort and risk taking with shareholder preferences. Thus, vega could be assumed to have a significant effect on volatility, especially since it is theoretically the effective component of the incentive pay to encourage risk taking.

4.4.2 Effect of age when CEO changes

My second regression includes a change dummy and an interaction term:

$Log\_vol = \beta_1 * log\_age + \beta_2 * CHANGE + \beta_3 * CHANGE * log\_age + \beta_4 * log\_delta + \beta_2 * log\_vega + \beta_3 * V + e$.

First of all, the purpose of this model is to explore, whether the effect of age is different in a CEO change situation than otherwise. In other words, the purpose is to find out if the relationship between age and volatility is different before the successions than after them. Secondly, the purpose is to examine the individual effect of CEO change on the dependent variable.

This model has an adjusted R squared of 0,354, which is higher than in the previous model. The existence of an interaction effect can be tested with an F change test. This statistics tests the null hypothesis that the model is additive, against the non-null hypothesis that there is an interaction. This can be done with SPSS Linear Regression module by dividing the independent variables into two blocks. The first block constitutes of the main effect variables and the second block of the interaction variable(s). (Seltman, 2012; pp. 262) The p-value of F Change is 0,001 and thus, the null hypothesis can be rejected and the non-null hypothesis of an interaction comes into effect.

As can be seen from the below table, age, change dummy, interaction variable, vega and delta all have statistically extremely significant regression coefficients. The signs of the coefficients are again negative for age, vega and delta. The coefficient of age is larger in this regression than in the previous one (in absolute terms). When the CEO age increases by one percent, stock return volatility drops by 0,028 percent. The absolute value of the standardized coefficient is actually larger than that of vega's, delta's and the year dummies', indicating that the relationship between

age and risk is also relatively stronger in this regression. Also the coefficient of the change dummy variable is negative, indicating that CEO succession itself has a negative effect on volatility. This finding is in line with the hypothesis number 2. Interpretation of the change dummy coefficient can be derived from the following equation: $g = \exp(c) - 1$, where c is the regression coefficient and g is the relative effect of the dummy variable on the dependent variable (Halvorsen and Palmquist, 1980). In this case, $g = \exp(-0{,}057) - 1 = -0{,}055$. When CEO changes, volatility decreases by 0,055 percent. The interaction term has a positive regression coefficient, indicating that the negative relationship between age and volatility is moderated by CEO succession: The negative relationship between age and volatility is weaker after the successions than before them. This finding supports the hypothesis number 3. Taken together, these results indicate that CEO age itself is negatively related to volatility but that CEO succession counterbalances this relationship. Collinearity statistics show that the model does not suffer from multicollinearity. The change dummy and the interaction term have high VIF values but this stems from using a product of two terms as a variable in the model. It is natural, that terms and their products are highly correlated. Year dummies are excluded from the below table since they take effectively similar values than in the first regression.

TABLE 11. REGRESSION COEFFICIENTS AND COLLINEARITY STATISICS FOR THE REGRESSION MODEL 2

	Unstandardized Coefficients		Standardized Coefficients	Collinearity statistics
variable	B	Std. Error	Beta	VIF
constant	**0,151***	0,012		
log_age	**-0,028***	0,003	**-0,271***	2,299
CHANGE	**-0,057***	0,016	**-2,029***	1080,373
CHANGE*log_age	**0,014***	0,004	**1,867***	1054,342
log_delta	**-0,002***	0,000	**-0,119***	1,632
log_vega	**-0,002***	0,000	**-0,199***	1,618
R squared	0,361			
Adj. R squared	0,354			
F sig.	**0,000**			

The logic of the moderator effect is illustrated below with scatterplots of volatility and age before and after CEO successions. The lines are fitted least square estimates of a simple linear regression with only one explanatory variable, age. It can be seen that the relationship between volatility and age is stronger before the successions than after them (the regression line is steeper in the pre-succession figure). This reflects the positive regression coefficient of the interaction variable. Another issue worth acknowledging is the persistence of the negative relationship between age and volatility. Theoretically speaking, the moderator effect of CEO change could be so strong that it would change the sign of the detected relationship between age and volatility. As can be seen from the below figures, however, the relationship remains negative also after the successions. Younger CEOs are still represented more strongly in the more volatile firms and older CEOs in the less risky companies. It can also be noticed, that the intercept of the regression line is larger pre- than post-succession, reflecting the negative relationship between volatility and CEO change.

FIGURE 3. SCATTERPLOT AND SIMPLE LINEAR REGRESSION FOR THE PRE-SUCCESSION SAMPLE
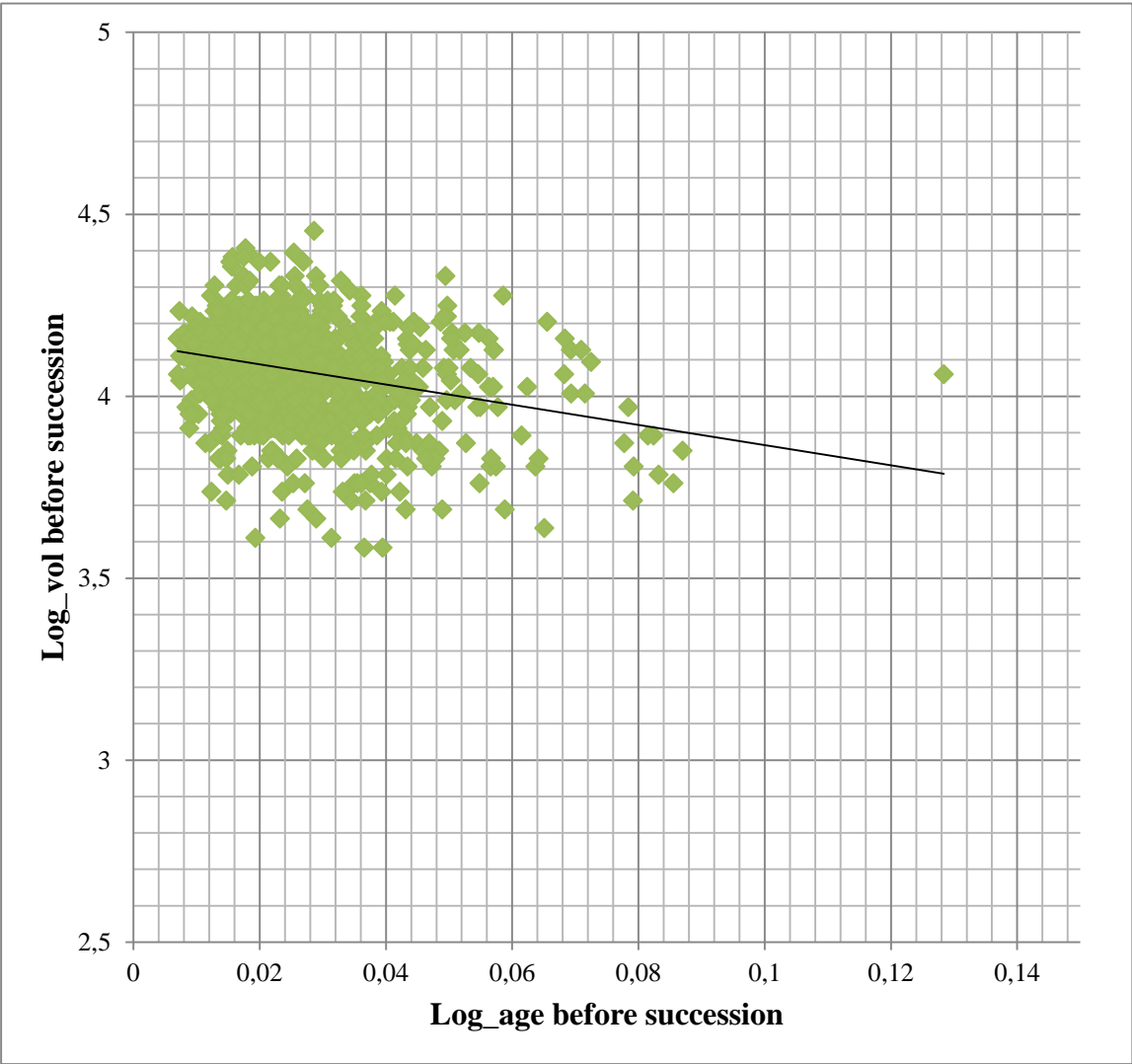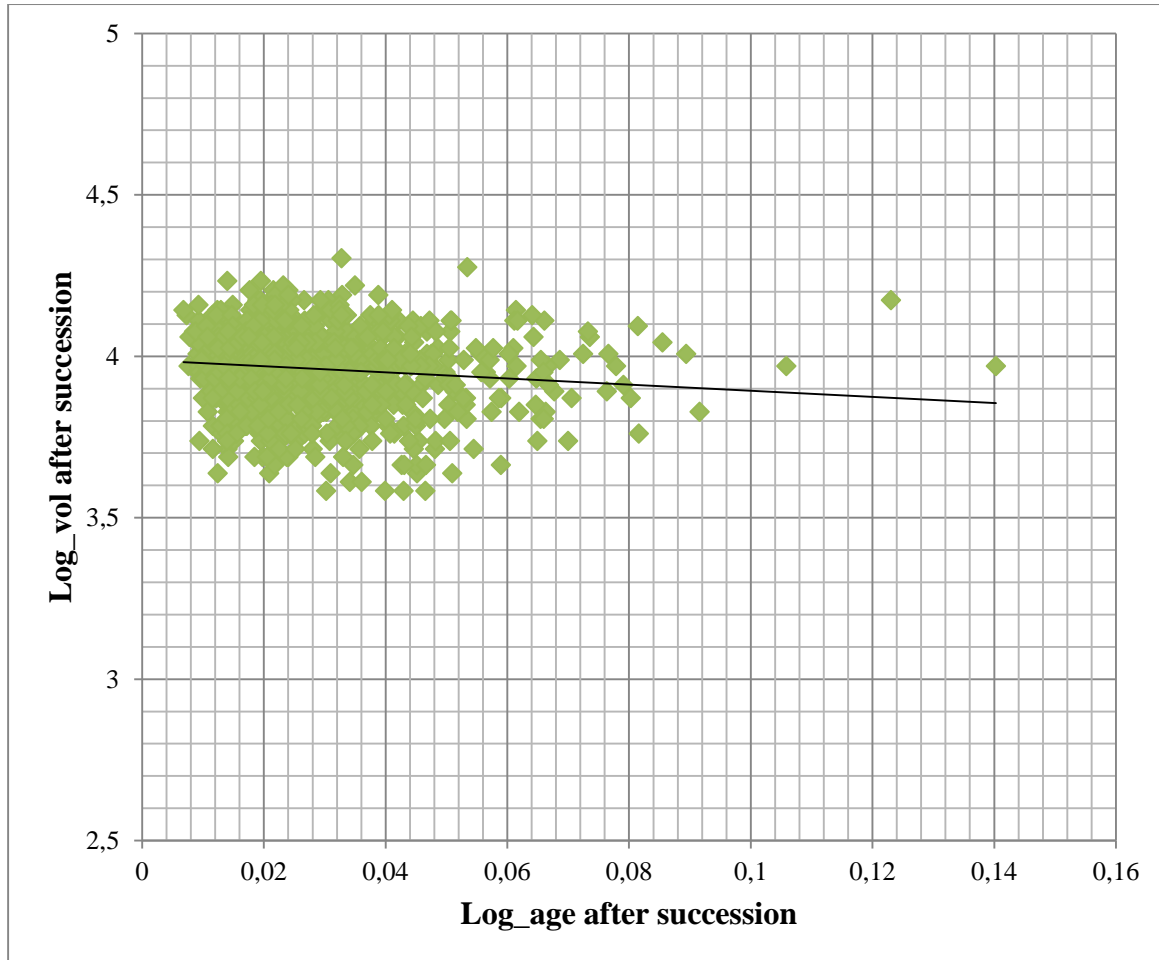
FIGURE 4. SCATTERPLOT AND SIMPLE LINEAR REGRESSION FOR THE POST-SUCCESSION SAMPLE

The below chart further illustrates the moderator effect discovered. I divided both the pre- and post-succession subsamples into four blocks of equal size on the basis of stock return volatility. The block 1 constitutes of observations with the lowest volatilities and the block 4 comprises the observations with the highest stock return volatilities. Both volatilities and CEO ages are proportioned to the means of the subsamples. This is done in the purpose of ruling out the absolute changes in the both variables due to the successions. It can be seen that the average age of the post-succession CEOs in the second quartile (blocks 1 and 2) is lower than the average age of the pre-turnover CEOs. Furthermore, the average CEO age in blocks 3 and 4 is higher for the post- than for the pre-succession CEOs. This suggests that the moderator effect comes from both ends of the

volatility spectrum. High-risk firms have chosen relatively older CEOs and low-risk companies relatively younger CEOs after the successions.

FIGURE 5. RELATIVE AVERAGE AGES PER VOLATILITY QUARTILES
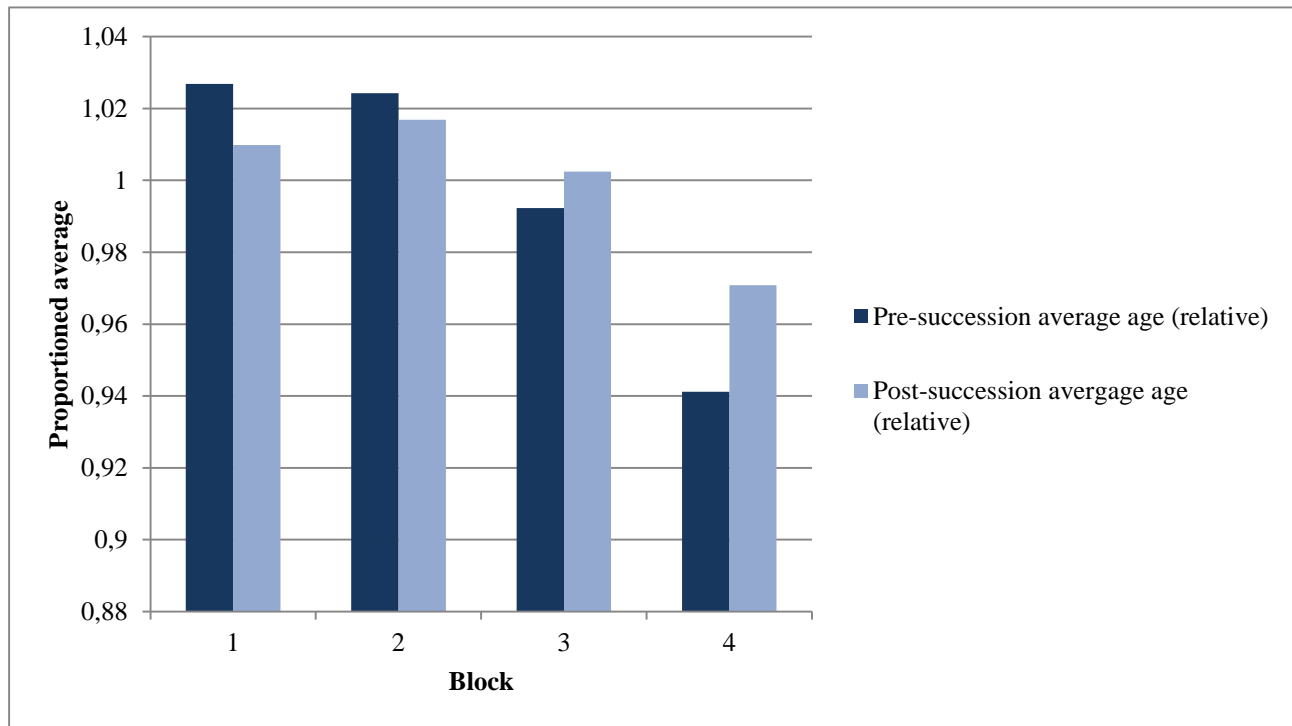
4.4.3 Effect of direction of the age change

The purpose of this model is to explore how much of the change in volatility can be attributed to the direction in which the CEO age changes:

$Log\_vol = \beta_1*log\_age + \beta_2*CHANGE + \beta_3*DIRECTION + \beta_4*log\_delta + \beta_2*log\_vega + \beta_3*V + e$

TABLE 12. REGRESSION COEFFICIENTS AND COLLINEARIY STATISICS FOR THE REGRESSION MODEL 3

Variable	Unstandardized Coefficients		Standardized Coefficients	Collinearity Statistics
	B	Std. Error	Beta	VIF
constant	**0,122*****	0,008		
log_age	**-0,021*****	0,002	**-0,196*****	1,241
CHANGE	**-0,004*****	0,001	**-0,132*****	1,527
DIRECTION	**-0,004*****	0,001	**-0,101*****	1,035
log_delta	**-0,002*****	0,000	**-0,123*****	1,629
log_vega	**-0,002*****	0,000	**-0,191*****	1,623
R squared	0,368			
Adj. R squared	0,360			
F sig.	**0,000**			

The results of this equation are in line with the previous regression. Age and CEO change are negatively related to stock return volatility. If the CEO changes from an older to a younger one, volatility is further reduced. This finding corresponds to the interaction effect found in the previous regression. The difference is that the direction dummy models the change in the *level of the average* volatility between the younger and older predecessor and successor CEOs. The interaction term in the prior model, on the other hand, represents the change in the *slope* of the relationship between age and volatility. The regression coefficient of DIRECTION indicates that when CEO age increases by one percent, stock return volatility drops by 0,021 percent. The CEO change dummy and the direction dummy both reduce the volatility by exp(-0,004) -1 = -0,004 percent. Other variables (vega, delta and year dummies) have similar kind of effects in this regression than in the previous one. The relative importance of the age coefficient is again higher than that of delta's and vega's.

4.5. CEO age and market-to-book ratio

In addition to the main analysis, I chose to examine if market-to-book ratio and CEO age are related. Paired t-tests indicate that MTB ratios are not statistically significantly related to CEO change or CEO age. The two-tailed p-value for the paired t-test is 0,682 when comparing MTB ratios pre- and post-succession. When comparing the group of CEOs that are younger counterparts in the successions to the group of older matched pairs, the p-value of the test is 0,640.

TABLE 13. PAIRED SAMPLES T-TESTS FOR MARKET-TO-BOOK RATIOS

	MTB before succession	MTB after succession	MTB older CEO	MTB younger CEO
Mean	3,047	2,607	2,576	3,078
Variance	158,893	1125,064	1183,943	99,985
N	1112	1112	1112	1112
Sig. (2-tailed)	0,682		0,64	

I also analyzed the correlation between age and MTB ratio. Pearson's correlation coefficient is not statistically significant and this result holds also for natural logarithms. All in all, there does not seem to be a significant relationship between these two variables and thus, further analysis can be neglected. This finding suggests that CEO age is not a significant determinant in investors' evaluations of the firm's future growth prospects.

TABLE 14. CORRELATIONS BETWEEN NON-LOGARITMIC AND LOGARITHMIC MTB RATIOS AND AGE

		Age	MTB ratio	Log_age	Log_MTB ratio
Age	Pearson Correlation		0,008	**0,995**[**]	0,009
MTB ratio	Pearson Correlation	0,008		0,006	**0,886**[**]
Log_age	Pearson Correlation	**0,995**[**]	0,006		0,007
Log_MTB ratio	Pearson Correlation	0,009	**0,886**[**]	0,007	

4.6. Heteroskedasticity and robustness of the model specification

Further analysis of the employed regression models reveals that there is some heteroskedasticity present in the employed models. Heteroskedasticity means that the variance of the error term is not constant for all observations (Dougherty, 2002; pp. 221). It may be a consequence of mathematical misspecification of the employed model (Dougherty, 2002; pp. 234) or it might be that some relevant variables have been omitted. By looking at the below scatterplot of the regression model number 2, for example, one can notice that the standardized regression residuals are not scattered entirely randomly. The smaller the predicted value of the dependent variable, the smaller the dispersion of the residuals. Larger estimates, on the other hand, have more variance in the error term.

FIGURE 6. SCATTERPLOT OF THE REGRESSION 2 RESIDUALS
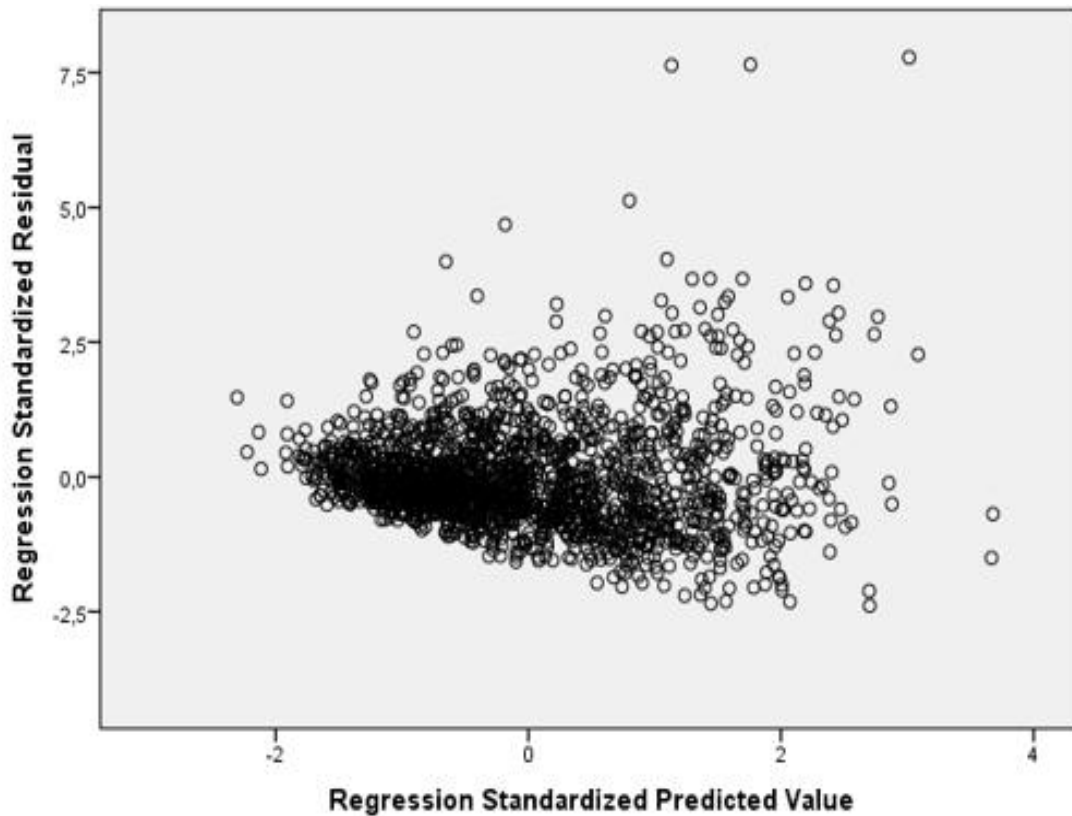
Although my initial presumption was that firm-specific control variables can be excluded from the model specification, it is possible that some statistically significant changes have happened in the sample firms during the observed three-year time frame. Thus, I included three new variables in the regression model number 2 to mitigate the detected heteroskedasticity. Based on the literature review, I chose three variables that have been shown to affect firm riskiness and might indicate changes in the risk-seeking strategy of the firm: financial leverage, R&D intensity and number of segments (a proxy for the level of diversification). All variables were transformed into a logarithmic form. Data was collected from the COMPUSTAT database and following variable definitions were employed (following Serling, 2014). COMPUSTAT items are in the parentheses.

$$Log\_leverage = ln\left(\frac{Long-term\ debt\ (DLTT)+Debt\ in\ current\ liabilities(DLC)}{Total\ assets\ (AT)}\right) \qquad (7)$$

$$Log\_R\&D = ln\left(\frac{Research\ and\ development\ expenditures\ (XRD)}{Total\ assets\ (AT)}\right) \qquad (8)$$

$$Log\_Segments = ln(Number\ of\ business\ segmants\ during\ the\ fiscal\ year) \qquad (9)$$

The below scatterplot indicates that the inclusion of these variables reduces heteroskedasticity. The variance of the standardized residuals does not increase consistently any longer and thus, the model specification can be inferred to have improved.

FIGURE 7. SCATTERPLOT OF THE REGRESSION 2 RESIDUALS (ADDITIONAL CONTROL VARIABLES INCLUDED)
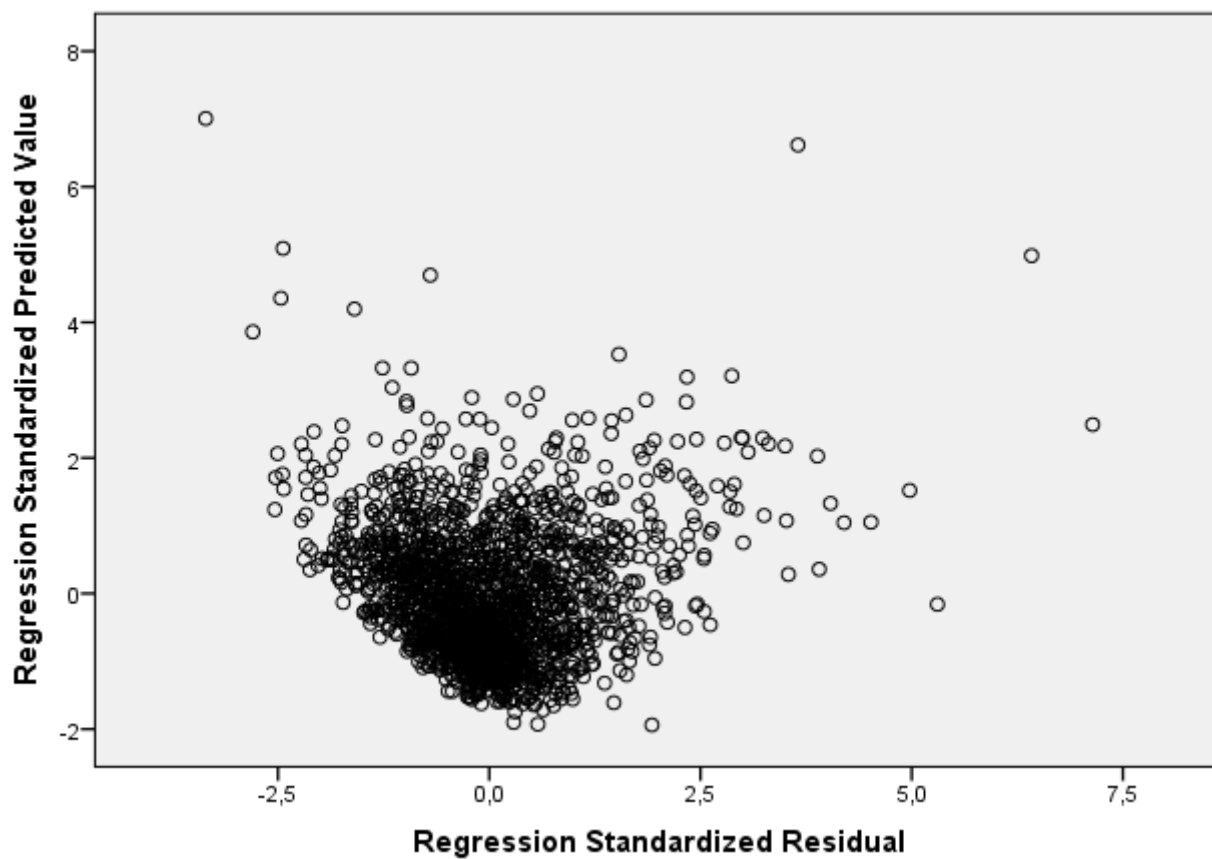
The below table shows the regression coefficients of the included variables. All the added variables are statistically extremely significant. The signs of the coefficients align with the predictions of the academic literature. Financial leverage and R&D intensity are positively related to stock return volatility. The level of diversification, on the other hand, is negatively related to firm risk. By looking at the standardized coefficients, one can notice that the effect of the R&D intensity is the most important of the added variables. The other independent variables are on the order of the initial regression specification. In addition to the above scatterplot, also the model summary statistics indicates that the corrected model is better specified than the original one. The adjusted R squared of the here employed model is 0,483, whereas the corresponding figure was only 0,354 for the initial regression.

TABLE 16. REGRESSION COEFFICIENTS AND COLLINEARITY STATISICS FOR THE REGRESSION MODEL 2 WITH ADDITIONAL CONTROL VARIABLES

Variable	Unstandardized Coefficients		Standardized Coefficients	Collinearity statistics
	B	Std. Error	Beta	VIF
constant	0,122***	0,011		
log_age	-0,022***	0,003	-0,214***	2,398
CHANGE	-0,061***	0,016	-2,161***	1066,348
log_age*CHANGE	0,014***	0,004	2,016***	1040,286
log_vega	-0,001***	0,000	-0,164***	1,675
log_delta	-0,001*	0,000	-0,056*	1,758
log_leverage	0,006***	0,001	0,158***	1,251
log_segments	-0,003***	0,000	-0,136***	1,226
log_R&D	0,072***	0,004	0,354***	1,565
R squared	0,490			
Adj. R squared	0,483			
F sig.	0,000			

Paired samples t-tests show how the means of the added variables have changed from time period t-1 to fiscal year t+2. The tests are statistically significant for all the logarithmic variables. The post-succession means of leverage, R&D intensity and the number of segments are all greater than the pre-succession averages. Thus, it can be suggested that the climb in the stock return volatility from the pre- to the post-succession sample relates to higher financial leverages and greater R&D intensities of the observed companies. Diversification has increased from year t-1 to year t+2 and thus, the detected negative relationship between the number of segments and volatility does not contribute to the pre- to post-succession increase in volatility.

TABLE 17. PAIRED SAMPLES T-TEST FOR THE INCLUDED VARIABLES

		Mean	N	Std. Deviation	Std. Error Mean	Difference	Sig. (2-tailed)
Pair 1	Log_leverage before	0,278	882	0,320	0,011	-0,026	**0,019**
	Log_leverage after	0,304	882	0,403	0,014		
Pair 2	Log_R&D before	0,034	882	0,060	0,002	-0,003	**0,033**
	Log_R&D after	0,037	882	0,077	0,003		
Pair 3	Log_segments before	0,856	882	0,750	0,025	-0,071	**0,000**
	Log_segments after	0,927	882	0,740	0,025		

Altogether, these results indicate that in addition to age, CEO succession, delta and vega, also other risk-adjusting factors contribute to the observed stock return volatility. The matched-pair design does not perfectly control firm-specific features since it is evident that the sample firms have experienced also other changes that affect their risk profiles. Without a more detailed analysis it remains unclear, however, what the in-depth dynamics of the estimated relationship is. More importantly, age and CEO succession remain significant predictors of firm risk even when adding other controls to the model.

5. Concluding remarks

Academic literature suggests that there is a significant relationship between individual's age and his or her propensity to seek risk. It has been shown that older individuals choose less risky alternatives when making decisions. Investment behavior research also supports the hypothesis that older people are more risk averse. Theoretical models of managerial risk taking offer conflicting predictions of the relationship. Research on CEO age and firm risk, on the other hand, further supports the hypothesis of a negative relationship between managerial age and risk. Since these studies use corporate risk measures, it has to be noted that the causality between age and risk is likely to be reciprocal. Managers might alter the firm policies to better reflect their own risk preferences but it is presumable that much of the correlation can be explained by CEO-firm matching. Younger CEOs might gravitate to more risky firms that offer dynamic growth opportunities, whereas older CEOs could be hypothesized to feel more at home in stable companies that strive to hold on to the status quo. On the other hand, more volatile businesses may prefer younger, innovative CEOs and less risky companies could be assumed to choose more experienced and conservative, older CEOs.

The purpose of this thesis was to explore how CEO age is related to firm's stock return volatility. It was also examined if CEO succession triggers changes in volatility and if the relationship between age and risk is altered by CEO turnover. CEO compensation variables were used as controls. A sample of 2224 CEOs of U.S. stock exchange listed corporations was gathered from the ExecuComp database and analyzed using IBM SPSS Statistics and Excel. Results from paired t-tests, correlations and regression analyses were mainly statistically significant.

The first finding of this thesis is that age and firm stock return volatility are negatively related to each other: Older the CEO, lower the volatility. Because I do not strive to further investigate the causalities between the variables, it remains unclear whether it is the CEO age that causes the shift in the volatility or vice versa. It might be that firms with higher volatilities attempt to choose younger CEOs to match their risk profiles, just as Serfling (2014) suggested in his research paper. Guthrie and Datta (1997) also argue that firms with more conservative strategies strive to hire older CEOs. On the other hand, it is just as possible that younger CEOs gravitate to lines of businesses

that offer them better growth opportunities and more dynamic environments. Furthermore, it is also conceivable that young CEOs might imprint their personal risk preferences to firm practices and make firms more volatile. Literature that has examined the impact of CEOs' personal preferences on firm practices supports this view. Serfling (2014) also argued that firms do not match CEOs to their personal risk preferences perfectly: CEOs also adjust corporate risk to better match their own preferences.

The second main finding of the thesis is the negative relationship between CEO change and volatility. As CEO changes, volatility drops (age controlled). This finding contradicts with previous findings in the academic literature (e.g. Clayton et. al, 2005). Clayton et al. suggested that uncertainty increases *after* CEO succession since investors are doubtful of the future firm strategy and the ability of the new CEO. However, it is just as plausible to assume that investors' uncertainty is greater *before* the succession. When rumors and official announcements of the CEO turnover come about, investors could be hypothesized to be pronouncedly unsure about the future. Before it becomes clear who is hired to replace the leaving CEO, there is uncertainty about both the identity of the CEO and the possible consequent changes in the firm strategies. In this study, the observations of predecessor CEOs are close to actual turnovers. Furthermore, most of the CEO successions in the sample are due to retirement. Hence, it is presumable that investors have been aware of the occurred turnovers already a year before the actual CEO change. Findings of this thesis suggest that uncertainty reduces as the new CEO is appointed. Since the post-succession observations are from year t+2, it can also be suggested that the strategy- and ability hypothesis have presumably lost strength in this time frame. After two years, much of the uncertainty about strategy changes and CEO ability has probably vanished. Another possible explanation for the relationship between CEO change and reduced volatility could be that CEOs are replaced more often when firms experience volatile returns. New CEOs might be hired in the purpose of stabilizing cash flows and reducing uncertainty. However, it remains unclear which share of the observed successions are forced and thus, this argument lacks credibility in this respect.

The third major finding is the interaction between CEO turnover and age. The negative relationship between age and volatility is weaker post- than pre-succession. By looking at the distribution of

age by volatility quartiles, one can see that two upper quartiles have relatively older CEOs post-than pre-succession. Two lower quartiles have relatively younger CEOs post- than pre-succession, respectively. It is possible that more volatile firms might have striven to reduce uncertainty by choosing relatively older CEOs and low-volatility firms might have wanted to expand their upside risk by choosing relatively younger CEOs. On the other hand, it is possible two interpret this result the other way around. It might be that older CEOs choose to take less risk before than after the turnover and adjust the firm risk to correspond to their personal risk-seeking attitudes. CEO change itself accounts for a decline in the average age of CEOs. Thus, older CEOs are closer to retirement pre- than post-succession. These CEOs have presumably been more concerned about their legacy in the company than CEOs that are relatively as old in the post-succession subsample. By this relative age I refer to the percentage divergence from the mean. Old post-succession CEOs have probably also been more worried about their asset accumulation and about the incapability to undo regretted actions. On the other hand, newly appointed young CEOs might have behaved more risk aversively than relatively as young pre-succession CEOs. Since uncertainty about their ability is greater than that of more tenured CEOs, it can be assumed that they would be pronouncedly willing to reduce excessive risk taking to avoid negative inferences and to reduce their employment risk. All in all, it is possible that career horizon and tenure issues account for the interaction effect discovered. Age itself is negatively related to risk, but tenure-related considerations might weaken the strength of this relationship in a CEO succession situation. Since tenure (or career horizon) is not controlled in the regression model, it might be that it accounts for the interaction.

Findings on delta and vega are surprising. Correlation and regression analysis shows that both variables are negatively related to firm risk. It is possible that firms with volatile returns avoid transferring a large amount of uncontrollable risk to CEOs and that this would account for the detected relationship. However, since the evidence of the power of vega (and to some extent also delta) to incentivize risk seeking is strong, this explanation seems unconvincing. Furthermore, high-volatility observations are scarce in the sample and it is thus unlikely that the avoidance of uncontrollable risk would account for the finding. A more probable reason for the result is that low risk firms want to encourage their newly appointed CEOs to take more risk by making their pay more sensitive to performance. In line with prior literature (Hill and Phan, 1991), age was found to

be positively related to pay-for-performance sensitivity (both vega and delta). As argued by Gibbons and Murphy (1992), this can also be regarded optimal. As uncertainty about the manager's talent reduces with tenure (and age respectively), the optimal level of pay-for-performance sensitivity rises.

Market-to-book ratio was not found to be significantly related to CEO age. It could be hypothesized that investors would incorporate the increased risk into stock prices and this would impact the market value of the firm. Furthermore, it might be that investors would see the future prospects of the firm less or more confidently depending on how young the CEO is. It seems, however, that investors do not incorporate CEO age in their evaluations of firms' future prospects but focus on other issues instead.

As a concluding remark, I summarize which of the hypotheses gained support and which did not. Following hypotheses were tested:

H1: CEO age is negatively related to stock return volatility.
H2: CEO change is positively related to stock return volatility.
H3: CEO change moderates the relationship between age and stock return volatility.
H4: Vega is positively related to stock return volatility.
H5: Delta is positively related to stock return volatility.
H6: CEO age is negatively related to market to book ratio.

Hypotheses 1 and 3 gained support. On the contrary, hypotheses 2, 4 and 5 and 6 were not supported. An opposite finding was made when testing hypotheses 2, 4 and 5. Instead of a positive relationship, CEO change was negatively related to stock return volatility. Furthermore, delta and vega were negatively, not positively, related to volatility. No relationship between age and MTB ratio was discovered.

There are limitations to this study. First of all, the data comes from the U.S., and it can be questioned if the results are generalizable across other economies. Secondly, the observed companies are large. CEOs of this large companies are typically not founder CEOs. Since founder

63

CEOs are typically younger than CEOs of large corporations and since young companies typically have a relatively high return volatility (Fink et al., 2006), it is likely that the relationship between age and risk is different for a sample that would also contain smaller, younger companies. The relationship could be hypothesized to be pronouncedly negative, perhaps. Another limitation is the use of stock return volatility as a proxy for firm risk. Since the measure incorporates both market and idiosyncratic risk, it can be argued that it might include noise. Year dummies can, however, mitigate this problem to some extent, since their coefficients reflect the effect of economy-wide fluctuations over time.

Probably the most considerable limitation to this study is the incapability to detect causality. A detected correlation between two variables can be caused by a third factor. It is also possible that the dependent variable actually causes the change in the independent variable and not the other way around. (Paavilainen, 2012; pp. 59) These problems are typical for correlative research and especially for cross-sectional studies. Organizing an experiment is practically the only way to prove causality. (Paavilainen, 2012; 61) In correlative research, instrumental variables are often used in order to draw inferences of causality (Angrist and Pischke, 2009; pp. 114). Yet, it is difficult to find a genuinely good instrument that would truly help in discovering causality (Angrist and Pischke, 2009; pp. 221). Thus, I chose not to run an instrumental variable regression in this thesis.

This thesis is a valuable contribution to the scarce literature examining the relationship between CEO age and corporate risk. The special credit of this study is the consideration of the role of CEO change. Prior studies of the subject have not simultaneously taken into account both the effect of age and CEO change and thus, an important part of the dynamics of the phenomenon remains unclear. A suggestion for future research could be a further examination of the causalities in the relationship. It could be studied, for example, how firm strategies change along with CEO successions and how these changes alter firm risk. This kind of investigation would better reflect how much of the relationship could possibly be attributed to CEOs' personal impact on the firm policies and how much of the variance is caused by CEO-firm matching.

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