How Does Managerial Equity Compensation Predict Risk Management?

A longitudinal Case-study in the U.S Oil and Gas Industry

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Abstract

Aim and Objectives

The aim of this thesis was to help explain how managerial equity compensation predicts corporate risk management through the effect it has on managerial incentives.

The exact research objectives changed during the research process. Originally, the research objective was to provide further empirical evidence in support of the common theory that a linear relationship exists between managerial equity compensation and risk management.

Conflicting research results led the author to rethink the nature of the relationship and prompted a change of objectives. Inspired by opposing arguments and ideas in the extant literature, this thesis presents a revised view on the relationship between equity compensation and risk management.

Therefore, the original research objectives were also revised and the resulting objectives were to 1) test the opposing arguments of a non-linear relationship between managerial equity compensation and risk management and 2) to examine the validity of the revised view presented by the author.

Boundaries

The thesis is limited to the oil and gas industry and companies listed in the US under SIC code 1311.

Methodology

This thesis used the U.S Oil and Gas Industry as a case study since these companies all share a common exposure to a volatile, globally traded commodity, namely oil.

Linear regression analysis was used to test for a linear relationship between managerial equity compensation and risk management. Analysis of variance (ANOVA)

was used to test for a non-linear relationship between different compositions of equity holdings (stocks and options) and risk management.

The sample included all companies with SIC code 1311 that also had consistent compensation data available in Execucomp between 1993 and 2014. The degree of risk management for each company was proxied for using the correlation coefficients between the stock price and the oil price for the individual firms.

Findings

The key findings of this thesis were that in contrast with the common theory, no evidence of a linear relationship between managerial equity compensation and corporate risk management was found.

Additionally, further analysis using analysis of variance supports the idea that a non-linear relationship exists and lends support to the revised view presented in this thesis. Contrary to popular belief, this suggests options may decrease a manager's appetite for risk in the presence of wealth or when deep in-the-money.

Conclusion

This thesis contributes to the discussion on how managerial compensation affects management incentives towards risk management in two ways. First, it provides empirical evidence in favor of the opposing arguments that a non-linear relationship between equity compensation and risk management exists. Second, building on the different opposing arguments and ideas in the extant literature of a non-linear relationship, this thesis proposes a revised view on how to better understand the relationship between equity compensation and risk management incentives. The research in this thesis provides mixed support for this proposition.

Implications

If the revised view presented in this thesis is correct, businesses can potentially design compensation contracts that better align managerial incentives with the interest of the shareholders.

Acknowledgement

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Declaration

I declare that this thesis is the result of my own work. Where appropriate, I have fully acknowledged the work and ideas of others and made proper reference to their work.

Table of Contents

List of tables

List of figures

Chapter 1
Introduction

1.1 Background & Context

In the past two decades the derivatives market has seen a significant growth and many non-financial firms have begun using derivatives as part of a risk management program (Dinica, Balea 2012). Similarly, the past 30 years have seen a significant growth in the amount of option based compensation for corporate executives (Gormley, Matsa et al. 2013).

In conjunction with this total growth in the use of derivatives, the field of research on what determines corporate risk management policy and the incentivizing effects of managerial stock and option compensation has been extensively studied (Stock and option compensation will henceforth be referred to as Equity Compensation).

Early economic theory proposed that under perfect capital market conditions, a company's financial decisions could not create value to the shareholder (Modigliani, Miller 1958), hence if corporate risk management is viewed as part of the financing decisions, it should only be able to create value for the shareholders if one or more of the conditions of the perfect capital market are violated.

Therefore, much of the literature is springs from how these violations might explain why companies manage risk.

Because managers ultimately make the decisions of the firm, the influence of managerial incentives on corporate risk management has received much attention as one of the main rationales behind why and how companies manage risk.

However, even with the extensive body of research present, the results are still inconclusive (Dinica, Balea 2012, Gormley, Matsa et al. 2013, Low 2009, Ross 2004, Tchistyi, Yermack et al. 2011)

The theoretical arguments on the exact effect that compensation has on managerial incentives vary, and empirical research is plagued by problems of endogeneity due to the interdependent relationship between compensation and risk taking as compensation-planning may also be affected by expectations of future risk (see section 2.3.2, p. 14)

1.2 Purpose of this Thesis

Because of the difficulty of determining the exact effect that equity compensation has on managerial incentives towards risk management, it is also difficult to determine if and how the corporate risk management policy is affected by managerial equity compensation.

The aim of this thesis was therefore to help explain how managerial equity compensation predicts corporate risk management through the effect it has on managerial incentives.

However, the exact research objectives changed during the research process. Originally, the research objective was to provide further empirical evidence in support of the common theory that a linear relationship exists between managerial equity compensation and risk management.

However, the significant lack of evidence of a linear relationship from the initial research prompted the author to re-evaluate the arguments in the extant literature. Inspired by the arguments opposing a linear-relationship[1], this thesis instead developed a revised view on the relationship between equity compensation and risk management.

[1] Especially (Lewellen 2006)

Therefore, the original research objectives were also revised. The objectives of this thesis could ultimately be summarized as follows[2]:

Table 1.1 – Research Objectives

Objective 1 - Test the common theory of a linear relationship between equity compensation and risk management using regression analysis.
Objective 2 - Test the revised theory that the relationship is nonlinear but can be determined and divided into distinct groupings that exhibit different levels risk management using ANOVA.
Objective 3 - Test the two theories against one another by comparing the individual expected outcomes of the ANOVAs to the actual outcome.

1.3 Significance of this Thesis

In light of the varying theoretical rationales on how compensation affects managerial incentives and the inconclusiveness of the empirical results so far, this thesis is significant in several ways.

1) It contributes to the empirical literature in finding no linear relationship between managerial equity compensation and corporate risk management.
2) It proposes a revised view on how to explain the relationship between compensation and incentives, attempting to bridge the results and rationales from previous research and the research presented here.
3) It provides partial support for the existing argument in the literature of a non-linear relationship
4) It provides partial support for the revised view presented in this thesis.

[2] Objective 1 was the original research objectives. Objective 2 and 3 are the revised objective resulting from the revised view on the nature of the relationship between equity compensation and risk management incentives.

1.4 Thesis Structure

This thesis is organized into six parts. Part I introduces the topic of the thesis and its context.

Part 2 reviews the extant literature in order to 1) outline the current understanding of why firms hedge and how managerial compensation affects corporate risk management policy 2) what empirical studies have been conducted so far and how they support these theories 3) discuss how the design and results of these may have affected the outcome of these studies and 4) present how this thesis will attempt to contribute to this body of research.

Part 3 explains the methodology and the research approach adopted in this thesis in order to reach the research objectives outlined in Part I and discusses what limitations this approach may impose on the model and its results.

Part 4 presents the analysis of the research results ordered by the stages of research before part 5 moves on to discuss the results and the interpretation of the research and how these interpretations may have varied under different assumptions. Finally part 6 provides the conclusion of this thesis and entails limitations and suggestions for future research.

Chapter 2
Review of the Literature

2.1 Introduction

This chapter will review the previous research on the determinants of corporate risk management. It will outline the current understanding of why firms hedge, quickly explaining the main theoretical rationales and what empirical studies support these.

Because the focus of this thesis is how managerial compensation may affect risk management, this review will then dive deeper into the literature concerned with managerial compensation and incentives as a rationale for risk management.

Here the thesis will also discuss how the design of these studies may have affected their results and what gaps may exists in the literature.

Finally, the conclusion of this chapter recaps the key findings of the literature review and presents how this thesis originally intended to contribute to the identified gaps, and how this changed following the revision of the research objectives as explained in chapter 1.

An important note: When looking at corporate risk management, papers typically look at corporate hedging as this is the most straight forward tool of corporate risk management that is reasonably observable to the researcher. Most papers therefore look at the use of financial derivatives to hedge various exposures such as interest rates [Borokhovich et al 2004], currencies [Stulz 1984] [Lel 2006], commodities [Buhl et al 2011] (Tufano 1996) and more.

However companies can also undertake alternate activities in place of financial risk management: Activities such as diversifying instead of hedging or stockpiling cash as a form of inverse leverage are all “operational” forms of risk management (Tufano 1996).

Similar to existing research, this thesis also deals exclusively with risk management through the use of financial derivatives when attempting to quantify the level of risk

management. This of course presents a limitation to the research and is also discussed in chapter 6 on limitations. Because of this, the terms hedging and risk management will also be used interchangeably.

2.2 Determinants of Corporate Risk Management - The Main Rationales

Early economic theory proposed that under perfect market conditions the financial decisions of a company cannot create value for the shareholders (Dinica, Balea 2012). In particular (Modigliani, Miller 1958) proposed that in the absence of taxes, informational asymmetries, financial distress costs and under the assumption that shareholders have access to the same transactions as companies, the financial policy of the company is irrelevant.

Hence in perfect capital markets the corporate risk management policy of the firm, when seen as part of its financial decision, can only create value for the firm if one or more of the conditions of perfect capital markets are violated (Dinica, Balea 2012).

In the words of (Stulz, Smith 1985)

> *"if a firm's hedging policy affects the value of the firm it must do so through either taxes, contracting costs or the impact that the hedging policy has on the investment decisions of the firm."*

(Dinica, Balea 2012) nuances this statement by saying that capital market imperfections that promote hedging refer to the direct and/or indirect costs of financial distress (bankruptcy costs), costly external financing and taxes.

The following sections look into each of these imperfects.

2.2.1. Taxes

In face of taxes, hedging has been shown to increase firm value through a number of ways.

Because hedging reduces firm risk, it enables companies to borrow more. (Leland 1998) shows that in this way hedging can be used to secure greater leverage and create value through the interest tax shield from the increased debt capacity.

(Stulz, Smith 1985) demonstrate how income volatility can be costly to firms that face a convex tax function. Through hedging firms can decrease the volatility of their taxable income, thus reducing taxes and increasing firm value.

2.2.2. Financial Distress

Much of the literature is concerned with how hedging can reduce the expected costs of bankruptcy and financial distress by lowering the probability of these events.

Financial distress costs in this setting cover a number of issues such as:

- Bankruptcy costs
- Costs of missing high-growth opportunities and investment opportunities
- Increased borrowing costs and other costs such as worsening relations with supplier and customers (Shapiro, Titman 1986).

Bankruptcy Costs & Debt Capacity

Papers that explicitly address bankruptcy costs commonly discuss the benefits of hedging related to debt capacity. By hedging, the company can reduce the probability of bankruptcy which reduces the firm's borrowing costs and creates value through increased debt capacity (Lel 2012, Leland 1998, Stulz, Smith 1985). Empirical results from (Borokhovich, Brunarski et al. 2004, Rogers 2002) support these arguments.

Under-Investment and financing growth opportunities

Similarly, for firms that face greater costs of financial distress in the form of missed investment opportunities, hedging cash flows may generate value if there is a probability that the cash-flows will fall below the level needed to support optimal levels of investment (Froot, Scharfstein et al. 1993, Stulz 1996).

(Froot, Scharfstein et al. 1993) argues that when informational asymmetry and bankruptcy costs result in convex costs functions for raising external capital, then investments made in low cash-flow states will be less than those made in high cash-flow states. If production functions are simultaneously concave, then the marginal value of investment will be higher in low cash-flow states. Hence if external financing is costly, hedging can generate value by transferring funds from high cash-flow states to low ones.

Or in other words, companies that hedge are less sensitive to variations in operating cash-flow and can better insure continuity of optimal operations.

Following the same logic, firms with greater growth opportunities will derive greater benefits from hedging (because of the reduction in underinvestment costs) (Stulz, Smith 1985).

Similar studies show that hedging plays an important role in ensuring that companies have the liquidity needed to support growth opportunities (Reflected in R&D expenses) or to support the dividend policy (Dinica, Balea 2012).

(Bessember 1991) argues that when firms simultaneously chooses their hedging policy and the debt level before selecting the optimal level of investment, the underinvestment problem is mitigated since debt values becomes less sensitive to increasing levels of investment and shareholders are the main beneficiaries of improved contracting terms with creditors.

In essence, financial distress arguments in favor of hedging, highlight the important role hedging plays in preventing situations in which direct or indirect costs of financial distress prevent a company from pursuing optimal investment opportunities (Stulz 1996) or in reducing the expected costs of bankruptcy by reducing its likelihood. Following the above logic, it is assumed that companies with high financial distress costs or a high probability of bankruptcy are also more likely to use hedging (Dinica, Balea 2012).

2.2.3. Empirical Findings

Mosts empirical studies validate the theoretical connection between increased debt and hedging (Bartram, Brown et al. 2009, Graham, Rogers 2002, Haushalter 2000, Guay 1999).

Likewise, the relationship between company liquidity and hedging is validated in many places (Allayannis, Brown et al. 2003, Dionne, Garand 2003, Geczy, Minton et al. 1997, Tufano 1996).

However (Dinica, Balea 2012) highlight that contrary to theoretical expectations, empirical studies also suggest that more profitable companies hedge more and that larger companies hedge more than smaller companies suggesting economies of scale.

Another interesting empirical finding by (Lel 2012) suggest that strongly governed firms tend to use hedging to limit currency exposure and overcome costly financing whereas more weakly governed firms seem to use derivatives primarily for managerial reasons.

This governance effect is also backed by (Borokhovich, Brunarski et al. 2004, Tufano 1996) who finds a negative relationship between block-holders and the use of derivatives.

2.2.4. Interim Conclusion

A large body of research exists on why companies might hedge unrelated to personal managerial incentives (opportunism / agency costs). The presence of these effects may of course affect the results of this thesis which is discussed further in the limitations section of chapter 6.

The remainder of this chapter will proceed to discuss in greater detail the literature and rationales for hedging related to agency costs and managerial compensation and incentives followed by the conclusion of the chapter.

2.2.5. Agency Costs

Since the actual risk management policy of the firm is decided upon by managers, agency problems have also been intensively studied as a determinant of corporate risk management policy.

With the separation of ownership and control in modern companies, shareholders delegate the decision-making to managers who act as agents of the shareholders with the responsibility to act in the shareholders best interest.

But because managers will seek to maximize their own utility, their goals may not always align with those of the shareholders.

Managerial Effort and Utility

One of the classical topics of agency theory is the choice of effort made by the agent. It's assumed that additional effort by the agent (manager) will generally increase the value of the firm but reduce the agent's private utility. However this problem of extracting utility is rarely addressed in the settings of managerial incentives since contracting theory demonstrates that the optimal contract to extract agent utility is one that forces the agent to invest in the outcome (Tirole 2006). With the wide use of stocks and options already present in managerial compensation, this particular problem has grown somewhat moot as extra effort that benefits the company, benefits the manager.

However a different argument worth mentioning is the need to ensure exposure to downside for the manager. This is described by (Taleb 2014) as the importance of skin-in-the-game. (Taleb 2014) makes hefty arguments against option compensation as it transfers the downside consequences of managerial actions away from the manager and onto the shareholder thereby encouraging recklessness. This aspect of compensation design is address further in chapter 6.

Risk Averseness

A more frequently addressed problem in managerial compensation, is that managers are typically less diversified than shareholders because of their substantial stake in the firm and thus more risk averse. Stake is typically considered in the form of wealth but can also be in the form of reputation and careerism (Hirshleifer 1993, Dinica, Balea 2012).

Because of this risk aversion, the argument goes that managers may not pursue the value maximizing investments and financial policies for the company in order to reduce total risk (Dinica, Balea 2012).

Thus, the under-invest problem described in the financial distress section may occur if the CEO passes on projects with a positive net present value because they are too risky for his taste (Armstrong, Vashishtha 2012).

Consequently, most of the literature concerned with managerial incentives as a determinant of risk management policy, explores how managerial compensation can be used to affects managerial incentives and increase the manager's appetite for risk in order to rectify this problem. This literature is explored next.

2.3 Managerial Equity Compensation and Incentives

2.3.1. Stocks

(Stulz, Smith 1985) argue that when a risk-averse manager holds a large proportion of his wealth in the form of company stocks and when it is less costly for the company to hedge the risk than it is for him, then the manager will engage the company in hedging operations. By doing so, he effectively hedges his own position at the expense of the shareholders. Therefore (Stulz, Smith 1985) predict a positive relationship between managerial share holdings and hedging. (Dinica, Balea 2012).

However, while this theoretical relationship between managerial stock holdings and the corporate hedging policy is supported by some empirical results, it is also invalidated by others (Dionne, Triki 2013, Dinica, Balea 2012, Haushalter 2000, Geczy, Minton et al. 1997, Tufano 1996).

On a sidenote, An entirely different argument for hedging as a result of managerial incentives is presented by (Breeden, Viswanathan 1998) showing that high-quality managers have a higher incentive to hedge in order to lock-in higher profits that are obtained because of their higher ability, while lower ability managers rather gamble, trying to appear like good managers (Dinica, Balea 2012).

All together, the theoretical rationale that managerial stock holdings create conflicts of interest between shareholders and managers and acts as a determinant of hedging finds only weak validation in empirical studies.

2.3.2. Options

Options present a special opportunity in designing managerial equity compensation because it allows for contracts with asymmetrical payoffs and varying payoff schedules. The use of call options in particular have been widely adopted under the

assumption that it counter-acts the risk-averseness induced by stock holdings because call options have no downside. Much of the current theory supports this view; however an increasing amount of studies are also questioning the rationales behind it.

(NOTE: In the remainder of this thesis, unless otherwise stated, options will refer to call options since most of the literature on managerial equity compensation is Discusses call options.)

Theoretical rationales

The common perception of options is that due to the convex nature of payoffs (ie. more upside than downside) they always incentive managers to increase risk (Haugen, Senbet 1981, Stulz, Smith 1985, Smith, Watts 1992).

However, despite the fact that the issue has been studied intensively by now, the evidence of this effect remains unclear (Gormley, Matsa et al. 2013).

On one hand, the fact that options allow managers to share in the gains but not all of the losses suggests that managers would be incentivized to increase risk (Jensen, Meckling 1976, Myers 1977, Stulz, Smith 1985, Smith, Watts 1992, Armstrong, Vashishtha 2012, Coles, Daniel et al. 2006) but on the other hand options contain a leveraged position in the firm so they could also magnify a risk-averse manager's exposure and further reduce his appetite for risk (Lambert 1991, Carpenter 2000, Ross 2004).

There is already a substantial amount of empirical evidence in favor of a positive correlation between using options in managerial equity compensation and different measures of risk such as variation in future cash flow from oil and gas exploration activity (Rajgopal, Shevlin 2002) Greater R&D Expenditures, less PPE investment (Property, plant and equipment), fewer lines of business, higher leverage (Coles, Daniel et al. 2006) exogenous increase in takeover protection (Low 2009) and use of performance sensitive debt contracts (Tchistyi, Yermack et al. 2011).

However, because a number of papers challenge the way that incentives towards risk are measured (see below) and highlight the endogeneity problems in these studies, further empirical results are still important.

Part of the theoretical ambiguity stems from the method of quantifying the managerial incentives to alter risk. (Guay 1999) demonstrates that specifically the convexity of stock options determine the sensitivity of a CEO's wealth to stock price volatility (or risk). (Core, Guay 2002) subsequently present a theoretical model using the partial derivatives of the dividend-adjusted Black&Scholes model to quantify the sensitivity of a manager's holdings to both changes in stock price (delta) and changes in stock volatility (vega), suggesting these measures may be useful as proxies for managerial incentives to increase stock price and volatility. (Rogers 2002, Coles, Daniel et al. 2006, Armstrong, Vashishtha 2012, Low 2009) use these measures to proxy for managerial incentives and provide evidence that compensation, risk-taking and vega is linked.

Essentially, the model presented by (Core, Guay 2002) calculates how portfolio holdings respond to changes in price and volatility based on the market valuation of options.

However, (Ross 2004) notes that

"[this] common folklore clearly has its genesis in the observation from option pricing theory that an increase in the volatility of an option makes it more valuable (Haugen, Senbet 1981, Stulz, Smith 1985, Smith, Watts 1992).This is, however, not the same as making the option more desirable to a risk averse investor"

He goes on to argue that one clear problem with this thinking is, that if an option grant is part of an incentive compensation package, then the agent will assess risk from a position of greater wealth and that an agent can have very different attitudes towards risk at higher levels of wealth.

Furthermore, he highlights the problem of using the market valuation in that:

> *"... The executive who cannot simply sell the options to pocket the increased value must instead evaluate them not with the linear valuation of the market but, rather, through the filter of their own personal preferences and trade-off between risk and return."*

This last point is also pointed out by (Lambert 1991, Carpenter 2000, Lewellen 2006).

(Lewellen 2006) takes the argument on wealth by (Ross 2004) further and argues that if managers are risk averse, not well diversified and unable to hedge their exposure to a firm's stock then in-the-money options actually discourage risk-taking and leverage as they increase the sensitivity of the manager's wealth to changes in the stock price (Delta). Out-of-the-money options would have the opposite effect as they provide protection from price declines, thus making volatility more attractive (Haugen, Senbet 1981, Stulz, Smith 1985, Smith, Watts 1992).

The Endogeneity problem

Another major problem faced by almost all empirical studies in the field so far, is to accurately determine the direction of causality between compensation incentives and risk given the obvious endogenous relationship between the two. Companies may anticipate future risky environments and design managerial compensation packages accordingly (Gormley, Matsa et al. 2013). Similarly (Rogers 2002) note that since options become more valuable with risk, managers of risky firms may desire option compensation.

In essence, even without the disagreement on the incentivizing effects of compensation, the current empirical research suggesting that risk management is partly determined by managerial compensation is also still unable to rule out that managerial compensation is determined by risk.

2.4 Conclusion

In reviewing the previous literature, this thesis highlights that the exact net effect of options and stocks on managerial incentives towards risk is still unclear and requires further research.

However as noted by (Ross 2004) and (Gormley, Matsa et al. 2013), despite this theoretical ambiguity, the common view assumes that:

- Options always incentivize managers to take more risk
- Stocks incentivize managers to decrease risk because they are risk averse

In the remainder of this thesis, this view will be referred to as the Common View as it is both widely supported in the literature and also underpins the trend of awarding managers with stock options to induce risk-taking.

Additionally, the main points of the literature review can be summarized as follows.

- The main rationales regarding the determinants of corporate risk management spring from perfect capital market imperfections and include taxes, cost of financial distress, company size, governance and agency problems.
- The theoretical rationale that options promote risk relies on their convex payoff structure and limited downside.
- Opposing rationales propose that the incentivizing effect of options varies with other factors such as managerial wealth and specific features of the option.
- Empirical support for both rationales is plagued by problem of endogeneity as there is an interdependent relationship between risk and compensation.

Even though the effect of managerial equity compensation has already been extensively studied, the net effect of different compositions of equity compensation remains unclear, with opposing theoretical models and troubled empirical evidence.

Originally, the interest area of this thesis stemmed from the need for further empirical research into the linear relationship between equity compensation and risk management.

The initial research of this thesis wanted to contribute to this gap by testing the Common View of a linear relationship between equity compensation and risk.

However, in conjunction with the revision of the objectives as explained in chapter 1, the author gained a deeper understanding of the opposing arguments in the literature presented in this review. From this new perspective, another area of interest emerged, namely to

- Examine the existence of a non-linear relationship between equity compensation and risk.
- Seek to bridge the opposing arguments in the literature by proposing a revised view on the nature of the relationship and test the validity of this view against the common theory.

The following chapter presents the methodology used in this thesis to accomplish this.

Chapter 3
Methodology

3.1 Guide

Because of the change in objectives during the research for this thesis, a brief guide for the remainder of the thesis is required.

Below in this introduction, the initial research objectives are presented together with the revised and final research objectives that were adopted later in the process.

Section 3.3 presents the research approach and philosophical paradigm used. Though the research objectives changed, the research approach and paradigms presented here did not.

Section 3.4 presents the research strategy and units of analysis. Like with section 3.3, although the research objectives changed, the research strategy and units of analysis did not.

Section 3.5 presents the intuition behind the design of the research model and choice of variables. Although the change in research objectives prompted a transformation of some of the variables, the basic intuition laid out in this section did not change.

Section 3.6 presents the model specifically used for the initial research, the results of which are presented in chapter 4 – Analysis, section 4.3.

These results prompted the author to propose a revised view on the nature of the relationship which is explained in Chapter 4 – Analysis, section 4.4.

Because this revised view led to a change in research objectives and guided the remainder of this thesis, it may be advisable to read section 4.3 and 4.4 of the analysis to better understand the research flow before proceeding through the methodology section.

3.2 Introduction

In the previous section, the literature review highlighted that further research is still needed to explain how exactly managerial equity compensation affects risk management.

In line with the initial objective to test the Common View for a linear relationship between equity compensation and risk, the initial research objectives were as follows:

Table 3.1 - Research Objectives

Objective 1 – Test the common theory of a linear relationship between equity compensation and risk management
Objective 2 – Test the common theory that option holdings provide incentives to increase risk
Objective 3 – Test the common theory that stock holdings provide incentives to reduce risk

These were the guiding objectives during the initial research for this thesis.

The results of this initial research led to the change of research objectives mentioned earlier, and resulted in the following revised research objectives.

Table 3.2 - Revised Research Objectives

Objective 1 - Test the common theory of a linear relationship between equity compensation and risk using regression analysis.
Objective 2 - Test the revised theory that the relationship is nonlinear but can be determined and divided into distinct groupings that exhibit different levels risk management.
Objective 3 - Test the two theories against one another by comparing the individual expected outcomes of the ANOVAs to the actual outcome.

The remainder of this chapter will present the research approach and the philosophical model that was used in pursuing these research objectives.

It will also explain the models used and the intuition behind them.

3.3 Research Approach and Philosophical Paradigm

The deductive, quantitative approach of this research (elaborated below) reflects the philosophy of the positivistic research paradigm as the researcher:

> *"adopts the philosophical stance of the natural scientist … collecting data about an observable reality and search[ing] for regularities and causal relationships in [the] data to create law-like generalizations…"* (Saunders, Lewis et al. 2012)

This paradigm was most suitable since the emphasis of the research was on quantifiable observations, well suited for statistical analysis, and since the research was assumed to be value-free in the sense that the researcher was external to the data collection process (Saunders, Lewis et al. 2012).

Furthermore, the objectivist ontology and the positivist epistemology was adopted as the research assumes that differences in the observed behavior of companies is a function of objective aspects of management and the goal of the research was to search for regularities in the examined data and attempt to create law-like generalizations (Saunders, Lewis et al. 2012).

3.3.1. Nature of research

Due to the large amount of existing literature on the topic at hand, the purpose of this research can best be described as analytical, or explanatory, as

> *"analytical research aims to understand phenomena by discovering and measuring causal relations among them" (Hussey, Hussey 1997).*

Accordingly, this research adopts a deductive, quantitative approach as opposed to an inductive and qualitative approach because the research aims to test existing theory with empirical observations (Hussey, Hussey 1997) and with the use of statistical database analysis.

However, in the interim phase of the research, in which the objectives are reformulated as a result of the initial results, the revised view is built on observations

from the initial research and existing ideas in the literature. Thus, this interim phase can best be described as an inductive, quantitative approach.

The remainder of the thesis which seeks to test and examine both the opposing arguments in the literature and this revised view can again best be described as deductive.

Ultimately, the overarching logic of this research can best be described as one of abduction as the approach moved back, forth and back again between deduction and induction, essentially combining deduction and induction in the same study (Suddaby 2006).

3.3.2. Positivism and ontology

The quantitative approach ties in well with the positivistic paradigm as the ontological assumption of the topic is that the reality is objective and apart from the researcher (Hussey, Hussey 1997).

The positivistic paradigm is typically considered to be at opposite ends with the phenomenological paradigm on the continuum of ontological assumptions since in the phenomenology paradigm; reality is believed to be a projection of human imagination (Hussey, Hussey 1997).

3.4 Research Strategy & Unit of Analysis

Inspired by the strategy adopted by (Tufano 1996) who examined the gold mining industry in the U.S, this research adopts a single case-study strategy. The case in question (The oil and gas industry in the U.S) represents a similarly unique case in that the industry shares a common exposure to a volatile, globally traded commodity, namely oil.

(Saunders, Lewis et al. 2012) explains that the strategy of a single case study is typically used when it represents a critical or unique case.

Additionally, an analytical case study is suitable when existing theory is used to understand and explain what is happening [Hussey and Hussey 1997].

In line with the positivistic research paradigm and the single case study strategy, the study adopts a longitudinal time horizon as the objectives of the research involves investigating the problem over a prolonged period of time (decades).

3.4.1. Data collection

The data used in this research was compiled from multiple sources of secondary data. The COMPUSTAT Execucomp database (company information and managerial compensation data), The Center for Research in Security Prices database (Company stock price data) and the U.S Energy Information Administration database (oil price data) were all used for collection of data.

As the Execucomp database ranges from 1992 to 2013 all data was collected from the period of 1993[3] to 2013 for companies with SIC code 1311 (Crude Petroleum and Natural Gas).

The use of secondary data in this research had the main advantage of allowing the researcher to analyze a dataset far larger, and of higher quality, than what would otherwise have been obtainable through primary data (Saunders, Lewis et al. 2012).

Similarly, since the time horizon of this research is longitudinal with the aim of covering as long a period as possible, secondary data was the only viable option for such a study.

3.5 The Research Model

The previous section described the research philosophy and strategy adopted for this research as well as the data collection method. In this section the intuition behind the design of the research models is explained and the models themselves are presented.

3.5.1. Design intuition

The overall aim of this thesis was to help explain how managerial equity compensation predicts corporate risk management through the effect it has on managerial incentives. Therefore, it was necessary to establish meaningful points of measurement for both the level of equity compensation and the level of corporate risk management.

[3] due to incomplete data in 1992, 1993 was chosen as a starting year

Risk Management Measurement

(Tufano 1996) looked at the gold mining industry in the U.S under the assumption that, as a result of their significant exposure to movements in the gold price, hedging the gold price would be their predominant form of risk management.

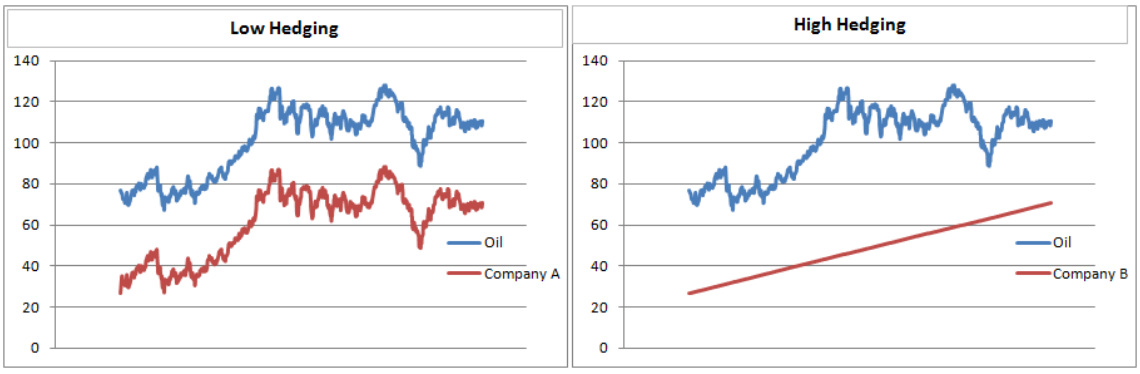
This provides a significant advantage to the researcher as it concentrates the companies' risk management which is otherwise difficult to quantify.

Following the same logic as (Tufano 1996), this thesis assumes that hedging against movements in the oil price presents the predominant form of the risk management in the Oil and Gas industry examined here.

Hence, this thesis assumes that for companies that employ high levels of risk management, the value of the firm will fluctuate less with the price of oil than for companies that employ low levels of risk management.

Consequently, this thesis adopts the correlation coefficient between the oil price and the stock price of the firm as a proxy for the level of risk management employed by the firm, where a high correlation coefficient implies low levels of risk management and vice versa. The logic is illustrated in below.

Figure 3.1 - hedging vs no hedging



In the exaggerated example above, Company A (left) decides not to hedge the oil price and thereby accepts higher risk as the company performance fluctuates strongly with the oil price (High correlation between oil price and stock price)

On the other hand, Company B (right) has hedged all their oil price exposure and thereby eliminated all risk towards the oil price, hence company performance does not fluctuate at all with the oil price (low correlation).

Managerial Equity Compensation

As highlighted in the literature review in chapter 2, the predominant form of equity compensation discussed in the literature is stocks and stock options.

Managerial Stock Holdings are reported and available through the Execucomp database, hence the $-value of managerial stock holdings was used to measure managerial equity compensation in the form of stocks.

As for managerial option holdings, because of data limitations regarding the features of the option contracts such as strike price and maturity dates, this thesis adopts a similar approach as that of (Tufano 1996) and uses *number of options held* to measure the effect of option ownership as an increase in the number of options tend to increase the convexity of the overall payoff.

3.5.2. Time periods

With the aim of testing whether managerial compensation explain risk management, it was necessary to introduce a time-lag in the data in order to examine whether the managerial compensation in one period predicted the risk management proxy in the next period.

With a range of data from 1992 to 2013 the data was separated into smaller time periods in order to test the managerial equity compensation of one period against the risk management policy of the next period. Hence the following 3-year time periods were constructed, 1993-1995, 1996-1998, 1999-2001, 2002-2004, 2005-2007, 2008-2010, 2011-2013.

The managerial equity compensation and control variables where measured at the start of each time period. Ie, 1993, 1995, 1998, 2001, 2004, 2007, 2010.

The correlation coefficient between the oil price and the stock price was calculated for each 3-year time period for each company.

The compensation data and control variables for the start of each time period were then tested against the correlation coefficient for the following 3-year period, illustrated in the table below.

Table 3.3 - Variable time-lag

Managerial Equity Compensation + Control variables	Oil price / Stock Price Correlation
1993	1993-1995
1995	1996-1998
1998	1999-2001
2001	2002-2004
2004	2005-2007
2007	2008-2010
2010	2011-2013

3.5.3. Variables

The following sections will explain in further detail how the variables used in the model were constructed to allow for a meaningful statistical analysis.

Risk Management Proxy

The correlation coefficient between firm's stock price and the oil price was used as a proxy for the degree of corporate risk management.

Hence, daily stock prices for all companies with SIC code 1311 was extracted from The Center for Research in Security Prices database. Similarly, daily oil prices were extracted from the U.S Energy Information Administration database.

For each company, the correlation between the daily stock price and the daily oil price was calculated for each of the 3-year time periods.

Managerial Equity Compensation & Control Variables

For each company SIC code 1311, the following quarterly data was downloaded from the Execucomp database from 1993 to 2013:

Table 3.4 - Database Variables used

Company Name
Restricted Stock Holdings $
Number of Unexercised, exercisable options
Number of Unexercised, un-exercisable options
Total Assets
Return on Equity

The following variables were constructed for each start-of-period years of the above described time-periods by summarizing the quarterly data into yearly data for each company.

Table 3.5 - Independent Variables

YEAR Restricted stock holdings $
YEAR Total Number of Options Holdings
YEAR Company Size (Total assets)
YEAR Company Performance (Return On Equity)

3.6 Research Stage I - The Regression Model

In the initial stage of research the author assumed that a linear relationship exists between managerial equity compensation and corporate risk management and that the relationship follows the common view on the matter.

In this view, the total number of option holdings would incentivize managers to decrease the level of risk management whereas stock value would incentivize managers to increase the level of risk management.

Hence at this stage the objective was to pursue the three original research objectives, namely

Table 3.6 - Original Research Objectives Recap

Objective 1 – Test the common view of a linear relationship between equity compensation and risk management
Objective 2 – Test the common view that option holdings provide incentives to increase risk
Objective 3 – Test the common view that stock holdings provide incentives to reduce risk

The expectation being that the model would show a statistically significant, negative relation between Restricted stock holdings $ and the oil/stock coeff, and a statistically significant, positive relation between Total Number of Options Holdings and the oil/stock coeff.

Accordingly, a multiple linear regression model was built with the oil/stock coefficients as dependent variable (which proxies for firm risk management), and number of options and restricted stock holdings as independent variables. Model validation was performed by visual inspection of residuals plots and using a normal probability plot for the standardized residuals of the models. The following hypothesis were stated and consequently tested:

- *H1: No linear relationship exists between Number.of.Options of Oil.Stock.Coeff.*
- *H2:No linear relationship exists between Restricted.Stock.Holdings and Oil.Stock.Coeff.*

The result of this model is presented in the Analyses chapter, section 4.3.

3.7 Interim Stage - The Revised View

Following the results of the regression analysis, the author sought to better understand and describe the relationship between managerial equity compensation and risk management policy (See section 4.4).

The revised view built on the views in the opposing literature that the relationship between equity compensation and risk policy was in fact nonlinear, and led to the proposition that the incentivizing effect of compensation depends on the composition of the equity compensation and that different groupings of stocks and options would show different levels of risk management.

As a result of this proposition, the adjusted research objectives were formed, repeated below.

Table 3.7 - Revised Research Objectives Recap

Objective 1 - Test the common theory of a linear relationship between equity compensation and risk using regression analysis.
Objective 2 - Test the revised theory that the relationship is nonlinear but can be determined and divided into distinct groupings that exhibit different levels risk management.
Objective 3 - Test the two theories against one another by comparing the individual expected outcomes of the ANOVAs to the actual outcome.

3.8 Research Stage II - The ANOVA model

Following the formation of the revised view, this second and last stage of the research seeks to pursue the second and third research objective (see above).

As the initial stage of research found statistically significant evidence of a linear relationship between the variables this section will seek to investigate whether there exists a non-linear relationship between the variables using a one-way analysis of variance (ANOVA) model.

3.8.1. Model Design and Intuition

As highlighted in the literature review in part 2 of this thesis, opposing theory suggest that the incentivizing effects of options vary with other factors such as the wealth of the CEO and the total convexity of their holdings.

Research objective 2 and 3 were therefore based on the idea that groups with different compositions of stocks and options would show different levels of risk management.

Hence, this stage of research wished to pursue these research objectives by dividing the data into groups and test for differences in the level of risk management between them. Groups formed are illustrated below.

Table 3.8 - Variable grouping

	Number.Of.Options	Restricted.Stock.Holdings
Group 1 (HH)	High	High
Group 2 (HL)	High	Low
Group 3 (LH)	Low	High
Group 4 (LL)	Low	Low

3.8.2. Variable Design

For this part of the research all entries were grouped into one of the four groups as follows. Using the same data as presented in the initial part of the research, the median value for the restricted stock holdings variable was identified as well as the median value for the Number.Of.Options variable.

All variables greater than the median were then classified as high and *vice versa*. The individual classification of Number.of.Options and Restricted.Stock.Holdings we're finally merged for each entry, providing an expression for each entry on the composition of options and stocks.

The final structure of the data set is illustrated in the table below.

Table 3.9 - Grouped Data Structure

TIME PERIOD	COMPANY NAME	RESTRICTED.STOCK.HOLDINGS $	NUMBER.OF.OPTIONS	CATEGORY	OIL/STOCK CORREL.COEFF.
1993.1995	Company A	High	Low	High.Low	
1996.1998	Company A	High	High	High.High	
1993.1995	Company B	Low	Low	Low.Low	
1996.1998	Company B	High	Low	High.Low	

For the ANOVA analysis, the following hypothesis were formed and tested:

- *H1: There is no difference between the groups in terms of Oil.Stock Coeff.*

After testing the main hypothesis, post-hoc analyses were performed to determine individual group differences. The following hypotheses were tested:

- *H2: There is no difference between Group HH and Group HL*
- *H3: There is no difference between Group HH and Group LH*

- *H4: There is no difference between Group HH and Group LL*
- *H5: There is no difference between Group HL and Group LH*
- *H6: There is no difference between Group HL and Group LL*
- *H7: There is no difference between Group LH and Group LL*

Hypothesis H1 was tested using a likelihood ratio F-test, comparing overall differences between groups in pursuit of research objective 2.

Hypothesis H2-H7 was tested, in pursuit of research objective 3, using post-hoc t-tests between individual groups. Models were validated by visual inspection of the residual plots.

The results of all tests are presented in the Analyses chapter (see section 4.5).

3.9 Conclusion

The aim of this chapter was to explain the research philosophy and the methods used for this explanatory study. The quantitative method of collecting secondary data from multiple databases was used to ensure the availability of data and to allow for a longitudinal study of the topic in a case study with a single unit of analysis. Consequently, the positivistic paradigm was adopted along with the objectivist ontology and positivist epistemology as the research was concerned with an objective observation and sought to create law-like generalizations.

Finally, the general logic of the research was best described as one of abduction, as the results of the initial stage of research led the author to formulate a revised view on the relationship being studied, reformulate the research objectives and test this new model under a new set of hypotheses.

Although the objectives changed during the research process, the overarching purpose of this research can be stated as follows:

Purpose Statement

The purpose of this explanatory case study was to test the theories of managerial equity compensation that relates the risk management of a company to the equity

compensation received by managers. The independent variable of risk was defined as the correlation between the companies' stock price and the oil price for a given period of time. The dependent variables were generally defined as the stock and option holdings held by management in the previous time period and the intervening variables of company size and company performance were statistically controlled for.

The following chapter presents the analysis of the findings and elaborates on the revised view proposed in this thesis.

Chapter 4
Analyses

4.1 Introduction

As presented in the previous chapter the focus of this analysis is *how managerial equity compensation affects risk management policy in the U.S Oil and Gas industry.*

The previous chapter presented how the data was collected, how meaningful variables we're constructed and what methods of statistical analysis were used to examine the research objectives at hand.

This chapter will first present the data that was used in the statistically analysis and revisits the construction of the variables.

It will then continue to present the results of the first stage of research along with their immediate interpretations.

The reformulation process of the research objectives will be presented before the results of the final analysis is presented.

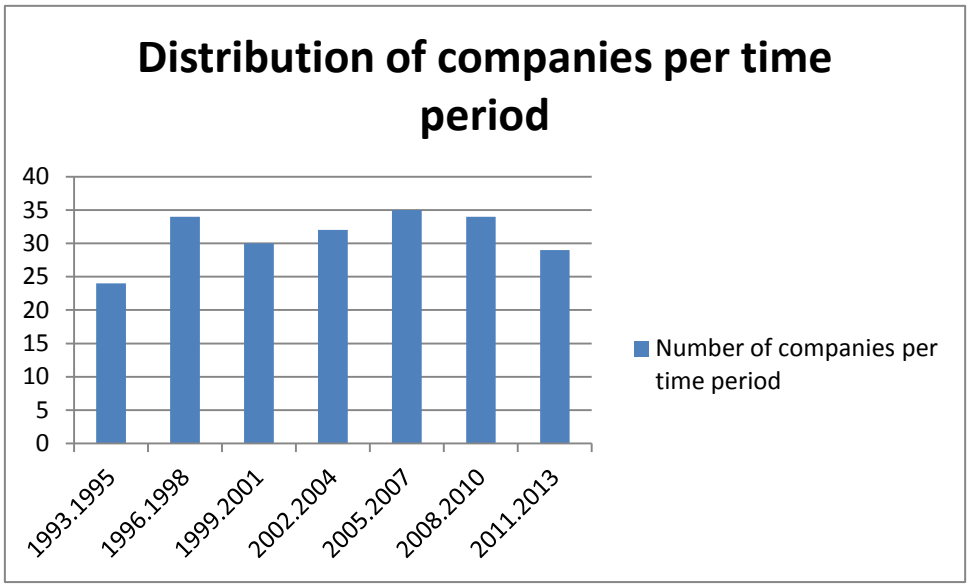
4.2 Data Presentation

4.2.1. Compensation Variables

The data on managerial compensation extracted from the Execucomp database from 1993 to 2013 contained 78 unique companies with SIC code 1311. However, due to insufficient data on a number of these companies, 17 of the companies were removed from the dataset to ensure that each of the remaining 61 company had data spanning at least 3 years.

Figure 4.1 illustrates the number of companies present in each of the time periods.

Figure 4.1 - Distribution of Companies



As illustrated, there were a fairly even number of companies present in each time period. Furthermore, the average company was present across three time periods (9 years) with one period (3 years) being the minimum and 7 periods (21 years) being the maximum.

As described in the methodology chapter, the compensation data included the following values:

- Restricted Stock Holdings $
- Number of Unexercised, unexercisable options
- Number of Unexercised, exercisable options

Number of unexercised, unexercisable options and number of unexercised, exercisable were combined into the total number of options, representing the total number of options held by management.

Since this total number of options and the restricted stock holdings $ were quarterly data, these were summarized into yearly data for each start-of-period and resulted in the following variables.

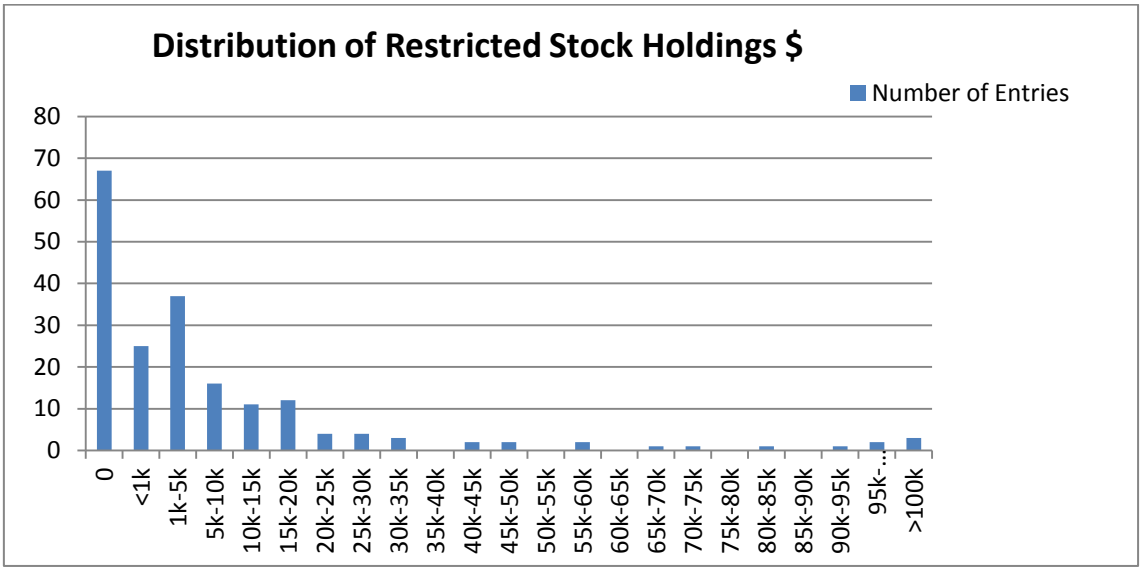
- YEAR Restricted Stock Holdings $ (Total $-value of stocks held by management)
- YEAR Total Number of Options (Total number of options held by management)

Restricted Stock holdings $

The average $-value of restricted stock holdings held by management was $12.211, with $332,508 being the maximum and $0 the minimum. in 64 of the 194 entries management held zero stocks.

The distribution of restricted stock holdings values can be seen the figure below.

Figure 4.2 - Distribution of restricted Stock Holdings

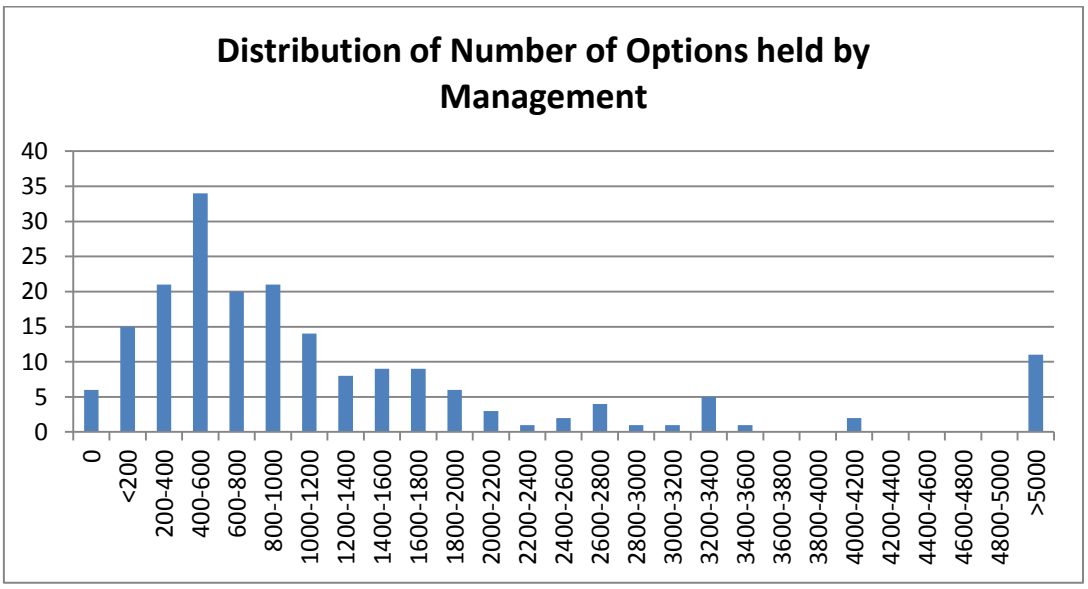


Number of Options

The average number of options held by management was 1.421 with 13.881 being the maximum and 0 being the minimum. In only 6 of the 194 entries did management hold zero options.

The distribution of the number of options held by management can be seen in the figure below.

Figure 4.3 - Distribution of Number of Options Held



The High/Low variable constructed in the second and last stage of research will be presented later in conjunction with the analysis of this stage.

4.2.2. Control Variables

The data on company size and performance extracted from the COMPUSTAT database from 1993 to 2013 comprised over 500 unique companies with SIC Code 1311. However as both compensation data (Execucomp) and company data (COMPUSTAT) was needed for each company in order to perform the analysis, only the data covering the 61 unique companies from the Execucomp database was extracted and matched accordingly.

Company Size

As seen in the literature review, managerial equity compensation might be greater for larger companies as (Guay 1999) finds a positive association between firm size and CEO-risk taking incentives, therefore company size was included as a control variable, measured as the $-value of total assets.

The size of the companies' assets ranged from $60m to $177bn with an average size of $8.976m.

Company Performance

Similarly, (Bertrand, Mullainathan 2001) shows that managerial equity compensation increases more during periods of high performance than it decreases during periods of low performance, hence company performance was included as a control variable, measured as the Return-on-equity of the company.

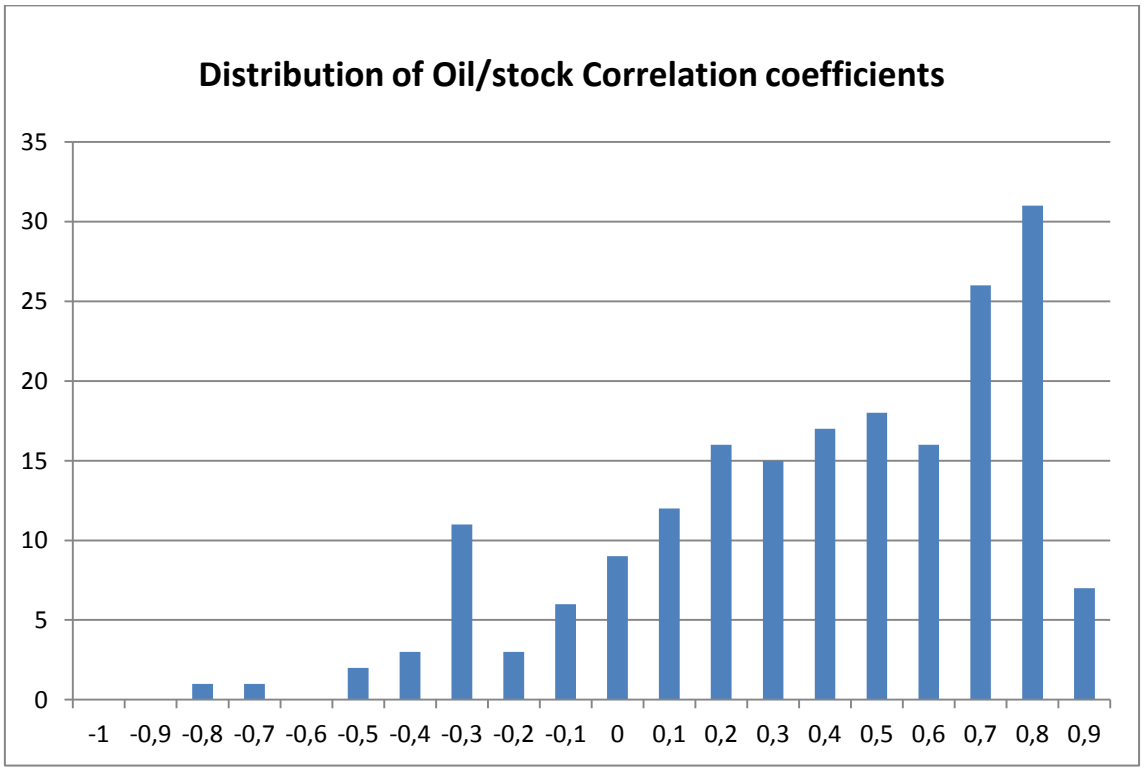
Return-on-Equity ranged from -8,06 to 1,92 with an average value of -0,03.

4.2.3. Risk Policy Proxy

As described in the previous chapter, in order to the measure the extent of corporate risk policy per company, the correlation coefficient between the daily oil price and the company's daily stock price was calculated for each time period for each company.

The figure below shows the distribution of Oil/Stock correlation coefficients.

Figure 4.4 - Distribution of Oil/Stock Coeffs.



The average correlation between the oil price and the stock price was 0,44 with 0,95 being the highest and 0,0002 being the lowest above zero and -0,78 the lowest below zero. Of the 194 total measurements, 27 exhibited a negative correlation.

4.3 Research Stage I Results

The following variables were constructed from the secondary data to be used in the initial research:

Table 4.1 - Variable Recap

Oil.Stock.Coeff (Correlation coefficient between oil price and company stock price)
Restricted.Stock.Holdings ($-value of stocks held by management)
Number.Of.Options (Number of stocks option held by management)
Company.Size (Total Assets $)
Company.Performance (ROE)

In this first stage of research this thesis sought to test the common theory of a linear relationship between managerial equity compensation and corporate risk management.

Accordingly, a multiple linear regression model was built with the Oil.Stock.Coeff as dependent variable (which proxies for firm risk policy), and Number.Of.Options and Restricted.Stock.Holdings as independent variables.

Model validation was performed by visual inspection of residuals plots and using a normal probability plot for the standardized residuals of the models. The following hypothesis were stated and consequently tested:

- *H1: No linear relationship exists between Number.of.Options of Oil.Stock.Coeff.*
- *H2: No linear relationship exists between Restricted.Stock.Holdings and Oil.Stock.Coeff.*

When the above variables were modeled against the oil.stock.coeff the following results were obtained:

Table 4.2 - Linear Regression Output

	Estimate	Std..Error	t.value	P-value
(Intercept)	0,425	0,034	12,639	<0,001
Number.of.options	1,30E-05	1,67E-05	0,779	0,437
Restricted.stock.holdings	-3,46E-07	1,40E-06	-0,247	0,805
Company.size	7,11E-08	2,64E-06	0,027	0,979
Company.performance	0,020	0,044	0,460	0,646

For the Number.Of.Options and Restricted.Stock.Holdings the respectively positive and negative estimate suggest a positive (negative) relationship with the oil.stock.coeff, implying that the oil/stock coefficient increases with the number of options held and decreases with the value of stock holdings. This is consistent with the common theory that options would incentivize managers to increase risk (and reduce risk management) and that stocks would decrease risk (and increase risk management). However, with the high p-values of respectively 0,437 and 0,805, the model is unable to refute neither H1 nor H2 that no linear relationship exists between either variable and the oil.stock.coeff.

In other words, the model finds no statistical significant, linear relationship between neither the $-value of stocks held, or the number of options held by managers and the Oil.Stock Coeff.

As for the control variables, with the similarly high p-values of 0,979 and 0,646 it's reasonably safe to say that company size and company performance can be excluded as confounding variables distorting the results.

4.3.1. Interim conclusion

This initial stage of research found no statistical significant evidence of a linear relationship between the constructed variables and, by extension, managerial equity

compensation and the risk management policy. Thus, so far this research runs counter to the common theory of a linear relationship.

The research faced a number of limiting factors, including the strength of governance and the composition of management teams, which are further discussed in the limitations section of chapter 5.

However, the lack of evidence prompted a reformulation of the research objectives as explained in earlier chapters. This reformulation is explained in greater detail in the following chapter along with the presentation of the revised view on the relationship between equity compensation and risk management proposed in this thesis.

4.4 Interim Stage – Model Reformulation

Counter to expectations, the initial research was unable to provide statistical significant evidence in favor of the Common View of a linear relationship between managerial equity compensation and corporate risk management.

Even though a number of limitations to the model were identified (see chapter 5) the results still led the author to more extensively question the common assumptions of a linear relationship.

As highlighted in the literature review, (Lewellen 2006) argues that if managers are risk averse, not well diversified and unable to hedge their exposure to a firm's stock then in-the-money options actually discourage risk-taking and leverage as they increase the sensitivity of the manager's wealth to changes in the stock price (Delta). In essence, options deep in-the-money behave like stocks only with the added effect of increasing sensitivity of the total holdings to stock price movements.

Similarly, (Ross 2004) argues that:

> *"... The executive who cannot simply sell the options to pocket the increased value must instead evaluate them not with the linear valuation of the market but, rather, through the filter of their own personal preferences and trade-off between risk and return."*

In essence, assuming the manager must hold the options to expiration, he will only increase volatility via a calculated risk he believes will pay off as the immediate price

increase is irrelevant and only the end result matters. Even if the manager holds no stocks that would directly impact him financially, (Gormley, Matsa et al. 2013) argues that he can still have exposure to left-tail events such as bankruptcy and employment loss, leading to personal losses, loss of private benefits and reputational damage.

In conclusion, even though a number of studies have shown option portfolios to increase risk-taking incentives, this need not always be the case, a notion also supported by (Lambert 1991, Carpenter 2000).

This thesis builds on these arguments and sought to combine them into a testable model. This revised view is explained below and elaborated further on in the discussion chapter.

4.4.1. Stocks introduce skin-in-the-game

A typical assumption in empirical papers on incentives is that stocks incentivize managers to reduce risk (Stulz, Smith 1985, Dinica, Balea 2012) as explained in Chapter 2.

However, this thesis suggests that for some companies stocks may not alter a manager's risk incentives but rather causes him to align his risk management strategy to his existing appetite for risk by introducing skin-in-the-game on behalf of the manager.

1) *Stocks by themselves do not alter the risk profile of the manager but incentivizes him to align the risk profile of the company to that of his own. Hence, stocks can actually encourage risk-taking for a manager more risk-seeking that the business that employs him.*

This point is inspired first by what was also highlighted in the literature review, namely that conflicts of interest between shareholders and managers as a result of managerial share holdings and as a determinant for hedging finds only weak validation in empirical studies.

Similarly, in the modeling of the optimal contract presented in (Tirole 2006), investment in the outcome on behalf of the agent is emphasized as the prime determinant of extracting effort. The purpose of having the agent invest in the outcome is best described by (Taleb 2014) as "skin-in-the-game" which acts as a safeguard towards recklessness and aligns the goal of the agent to that of the principal.

Combining the logic of (Tirole 2006) and (Taleb 2014), one can argue that stocks incentivize the manager to apply effort beyond the minimum requirement and align his actions to his own preferences for risk.

However, this thesis acknowledges the fact that stocks as an incentive to reduce risk is a common assumptions in empirical studies which this thesis also found corroborating evidence for.

4.4.2. The Magnification[4] Effect of Options

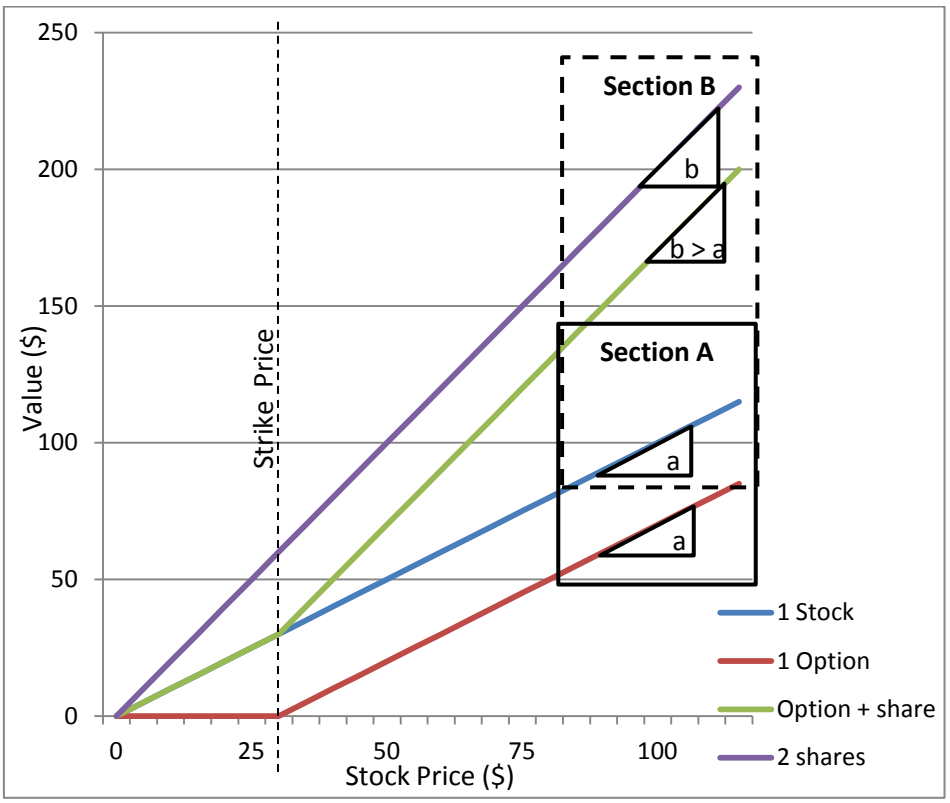
As presented by (Lewellen 2006, Ross 2004), the incentivizing effect of options may change with the features of the option such as whether it is in or out of the money.
The revised view presented in this thesis follows these arguments and suggests that:

2) *The incentive-altering effect of options decrease the further it moves into the money. When deep in-the-money, options behave the same as, with the addition of magnifying his behavior due to the increased sensitivity to price changes if he also holds stocks.*

If we look at a single stock compared to a single option then the value as a function of the stock price will be as illustrated in the figure below.

[4] Named so by (Ross 2004)

Figure 4.5 - In the Money Options



As can be seen in Section A, the option exhibits the same behavior as the stock when deep in the money, except at a lower level of wealth equal to the share price minus the strike price. In other words, the sensitivity to changes in the stock price is the same for the option and for the stock.

Additionally, if the option is held together with a stock, the sensitivity of the total holdings to changes in the stock price is greater and equal to the sensitivity of holding 2 stocks.

This is highly relevant as per the notion in (Ross 2004) that the manager's must hold options to expiration, in essence neutralizing the increased value placed on options by the market when volatility increases.

For options out of or at-the-money, this model recognizes that options would greatly promote risk-taking when seen in isolation as they present no downside.

4.4.3. The Wealth[5] effect of Options

Similarly, as presented in (Ross 2004), the incentivizing effect of options my change with the amount of wealth held by the manager.

This thesis adopts this argument proposing that:

3) *The incentive-altering effect of options also depends on the amount of wealth the manager has tied to firm-specific investment. The propensity towards risk from options at-the-money and out-of the money are diluted as wealth increases.*

If we suppose that the manager holds a large portion of options at-the-money then seen in isolation, this would encourage him to increase risk as the options would gain from all winnings but suffer none of the losses.

However if the manager simultaneously has great wealth tied to firm-specific investments such as stocks, this reintroduces downside on behalf of the manager as any increase in risk would also jeopardize his existing wealth. Hence, firm-specific wealth will dilute the risk-increasing incentives from options through persistent downside.

In summary, the revised view presented in this thesis argues that:

Table 4.3 - Thesis Revised View

1. *For some companies, stocks by themselves may not alter the risk profile of the manager but incentivizes him to align the risk profile of the company to that of his own.*
2. *The incentivizing effect of options decrease the further it moves into the money. Deep in-the-money options behave like stocks and they increase the total sensitivity to price changes if he also holds stocks.*
3. *The incentivizing effect of options also depends on the amount of wealth the manager has tied to firm-specific investment. The propensity towards risk from options at-the-money and out-of the money are diluted as wealth increases.*

[5] Also named by (Ross 2004)

4.4.4. Theoretical Implications

The following section assumes the basic framework of principal-agent models (Rogers 2002) and assume the principal (the shareholders) is risk-neutral and the agent (the manager) is risk-averse.

We also assume that the greater the number of options held, the more of them will be deep in-the-money.

Under these assumptions and with the revised view presented above, we can deduct the following:

1) A manager with high stock holdings and few to no option holdings will seek to reduce risk because he is more risk-averse than the business that employs him.
2) A manager with high stock holdings and a high number of stocks options will seek to reduce risk as his high share of in-the-money options increase his risk-averseness together with his already significant exposure through his firm-specific wealth.
3) A Manager with a high number of options and few to no stock holdings will behave similar to the manager with high stock holdings as the high share of in-the-money options exhibit the same features as stock holdings wealth.

This runs opposite to the assumptions of the common theory as these would argue that whether the manager holds stocks or not, his option holdings will incentive him to increase risk.

In the next section these sets of assumptions are reformulated into testable hypotheses and subjected to further statistical testing.

4.5 Research Stage II Results

As described in the methodology section, the compensation data was grouped into different compositions of stocks and option holdings. For each entry the value of the variables Restricted Stock Holdings and Number of Options we're categorized as either high or low, with high defined as values above the median and vice versa.

These categorized were then merged into a single expression for each entry, indicating the composition of stock and option holdings by falling into one of four groups:

- HIGH options, HIGH stocks (HIGH.HIGH)
- HIGH options, LOW stocks (HIGH.LOW)
- LOW Options, High Stocks (LOW.HIGH)
- LOW Options, Low Stocks (LOW.LOW)

An example of the categorization can be seen in appendix 1.

The number of entries in each category is illustrated in below.

Table 4.4 - Distribution of Groups

	HIGH OPTIONS	LOW OPTIONS
HIGH STOCKS	60	37
LOW STOCKS	37	60

Using analysis of variances (ANOVA's) this thesis then tested for differences among the groups in respect to the oil.stock.coeff (the amount of risk management). In other words, by first testing for whether or not the groups differ from each other this model would find evidence for whether or not the *composition* of stocks and options predict the level of risk management, and second, by testing for the level of difference between the groups this model would find evidence of which groups promote more risk and which promote less risk.

Following the logic laid out in the previous section on theoretical implications, the expected rankings among the groups would be as follows (Ranked from most risk-taking to least) see table below.

Table 4.5 - Expected Group Rankings

Ranking of groups (Ranked from most to least risk-taking)	
Common theory	Author Theory
High Options, Low Stocks	Low Options, High Stocks
High Options, High Stocks	High Options, High Stocks
Low Options, High Stocks	High Options, Low Stocks

Before we can speculate on the predicted ranking of the Low.Low group however, some further insight into the composition of this group is required.

4.5.1. The Low.Low Group

At face value the low.low group is arbitrary since the purpose is to examine the effect of the composition of stocks and options and at face value the researcher is unable to say anything about this composition other than both holdings are below the median value. However, the interpretation of the results from this group would be very different if most of the entries were double zeroes or if option holdings were systematically significantly greater than stock holdings.

Hence a closer inspection of the data was necessary.

The Low.Low group had a total of 60 entries. Of the 60 entries, only 5 hold neither stocks nor options. This was good news as this research was only interested in the effect of stocks and options and the fear was that the low.low group would contain many double zeros In which case it would truly be arbitrary, fortunately this was not the case.

Of the 60 entries, a total of 37 of them held options but no stocks, while none of them held stocks without options.

These findings were highly relevant as it allowed the research to draw certain conclusions regarding the expected outcome of the analysis. The composition of the Low.low group is summarized in the table below.

Table 4.6 - Low.Low Group Composition

Low.low Group Analysis (Total entries: 60)		
	No options	Options
No Stocks	5	37
Stocks	0	18

Since this research was only interested in the effect of stocks and options this research disregarded the double zero holdings as they only constitute 8% of the total group.

The following can be stated about the rest of the low.low group.

- All entries have option holdings.
- The majority of these hold no stocks.
- In 8 of the 18 entries that hold both stocks and options, the number of options exceeds the value of stock holdings. Hence options dominate stocks.
- In only 10 of the 55 entries, stocks value is significantly higher than number of options and might dominate options in these cases.

By applying the same logic as outlined in the "Theoretical Limitations" section, then the low.low groups should greatly promote risk as in 37 of the 60 entries the manager has no downside as the majority of his options will be near-the-money since his holdings are generally low. Of the remaining 23 entries, 8 of the managers have far greater options holdings that stocks. In essence, for the low.low group options dominate stocks in 45 of the 60 entries. Hence both the common theory and the

revised view presented here would argue that the low.low group promotes risk and the low.low group would fit into the ranking as illustrated in the table below.

Table 4.7 - Expected group rankings 2

Ranking of groups (Ranked from most to least risk-taking)	
Common Theory	Author Theory
High Options, Low Stocks	Low options, low stocks
High Options, High Stocks	Low Options, High Stocks
Low options, low stocks	High Options, High Stocks
Low Options, High Stocks	High Options, Low Stocks

With the above rankings in hand, the research can now test the two theories against each other by comparing the outcome of the ANOVA's to the expected outcome of the respective theories.

4.5.2. ANOVA results

To summarize, the ANOVA models seek to test the following hypotheses

- H1*: There is no difference between the groups in terms of Oil.Stock Coeff*
- *H2: There is no difference between Group HH and Group HL*
- *H3: There is no difference between Group HH and Group LH*
- *H4: There is no difference between Group HH and Group LL*
- *H5: There is no difference between Group HL and Group LH*
- *H6: There is no difference between Group HL and Group LL*

- *H7: There is no difference between Group LH and Group LL*

The complete output of the ANOVA's are illustrated below-

Table 4.8 - Anova output

Likelihood ratio F-test			
p=0.03195			
Estimate and std. Error for groups			
	Estimate	Std..Error	
HIGH.HIGH	0,5705	0,0551	
HIGH.LOW	0,3224	0,0682	
LOW.HIGH	0,4723	0,0682	
LOW.LOW	0,4052	0,0551	
Differnece between HIGH.HIGH and:	Estimate	Std..Error	Pr...t..
HIGH.LOW	-0,2481	0,0877	0,0053
LOW.HIGH	-0,0982	0,0877	0,2646
LOW.LOW	-0,1653	0,0779	0,0356
Difference between HIGH.LOW and:	Estimate	Std..Error	Pr...t..
LOW.HIGH	0,1499	0,0965	0,1224
LOW.LOW	0,0828	0,0877	0,3466
Difference between LOW.HIGH and:	Estimate	Std..Error	Pr...t..
LOW.LOW	-0,0671	0,0877	0,4454

Hypothesis H1 was tested using a likelihood ratio F-test, comparing overall differences between groups and resulted in p=0.03195. Hence the F-test finds statistically significant evidence to refute

H1: There is no difference between the groups in terms of Oil.Stock Coeff.

In other words, it suggests that a significant difference between the groups exist in terms of oil.stock.coeff. It thus provides evidence in support of the opposing theory, and the revised idea presented in this thesis, that a nonlinear relationship exists between equity compensation and risk management.

Hypothesis H2-H7 was tested using post-hoc t-tests between individual groups. For easy comparison the results are summarized below.

Table 4.9 - Differences among Groups

	HH	LH	LL	HL
HH	-	0,26459	0,03555	0,00532
LH		-	0,44541	0,12242
LL			-	0,34661
HL				-

With p-values of respectively 0,03555 and 0,00532 the t-tests found statistically significant evidence to refute

H2: There is no difference between Group HH and Group HL

H4: There is no difference between Group HH and Group LL

In other words, it suggested that a significant difference exists between group HH and HL, and group HH and LL in terms of oil.stock.coeff.

With a p-value of 0,12242 the test didn't find strong statistical evidence to refute

H5: There is no difference between Group HL and Group LH

However, the p-value is still low and it can be argued that t-test found borderline evidence that a difference exists between group HL and LH.

With the remaining p-values above 0,25, the tests did not find significant evidence to refute hypothesis

H3: There is no difference between Group HH and Group LH

H6: There is no difference between Group HL and Group LL

H7: There is no difference between Group LH and Group LL

Hence, the model found no evidence that a difference exists between these respective groups.

The analyses of the ANOVA models suggest that, when ranked from highest risk to lowest, the ordering is as follows:

1. High options, high stocks

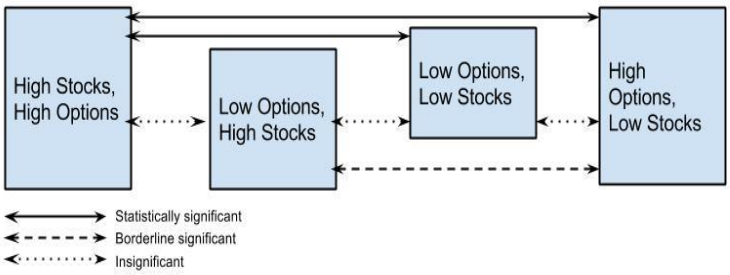
2. Low Options, high stock

3. Low options, low stock

4. High options, low stock

However, not all the groups are different from each other at statistically significant levels and is best illustrated in the figure below.

Figure 4.6 - Difference among Groups Illustrated



The figure reflects the groups with the highest difference between them are also the ones that are statistically most significant.

The table below compares the outcome of the ANOVA's to the expected outcomes of the common theory and the revised view this thesis sought to test.

Figure 4.7 - Group ranking comparison

Ranking Comparison		
Common theory	Thesis Proposition	Result
High Options, Low Stocks	Low options, low stocks	High Options, High Stocks
High Options, High Stocks	Low Options, High Stocks	Low Options, High Stocks
Low options, low stocks	High Options, High Stocks	Low Options, Low Stocks
Low Options, High Stocks	High Options, Low Stocks	High Options, Low Stocks

As can be seen from the comparison the results are mixed.

At face value, the result lends some support to the view proposed in this thesis as the High Options, Low Stocks ranks as the group with the least amount of risk, in line with the view proposed here and at complete opposites of what would be expected from

the common view. The results from the research also ranks the Low Options/High Stocks group relatively high in terms of risk which again flies against the expectations of the common view but aligns with the view proposed here that stocks alone need not provide greater incentives to reduce risk than options.

However, the High Options, High Stocks group being ranked as the group with the highest risk of course provide support for the common view.

Looking a bit deeper and including the perspective of which groups differ significantly from each other, the most important result is the difference between the High Options/High Stocks group and the High Options/Low Stocks Group. While the placement of High Options/High Stocks as the most risky group aligns with the common theory, the result that the High Options/Low Stocks group has significantly less risk seriously undermines the common theory that options provide incentives to take risk.

Similarly, the borderline significant difference between the Low Options/High Stocks group and the High Options/Low Stocks group undermines this rationale in the common theory as well.

Meanwhile, the result that the High Options/High Stocks group is ranked as the most risky, opposite the expectation of the view proposed here, could be explained by the rationale that the most risk-seeking managers might negotiate the most equity compensation.

4.6 Conclusion

The results of the initial research were unable to find a significant linear relationship between managerial equity compensation and amount of corporate risk management. Although the research model used faced a number of limitations (see section 5.2) the overall results of this first stage still run counter to the common view on managerial equity compensation and corporate risk management.

Because of these results, this thesis presented an adjusted view on how equity compensation affects managerial incentives inspired primarily by (Lewellen 2006, Ross 2004).

Contrary to the common view, this revised view suggested that in most cases compensation in the form of options will actually discourage risk because of the increased sensitivity it puts on wealth and because once deep in-the-money, options will behave like stocks, rendering the no-downside argument moot.

By analyzing the variance between different groups of equity compensation this research was able to establish a partially statistically significant ranking of the groups, showing which compositions of stocks and options had systematically higher risk associated with them.

By comparing this ranking to the expected ranking of the common view and the view proposed in this thesis, this research stage was able to test the two views against each other.

While the results were still inconclusive due to a lack of significant difference between some groups and mixed interpretations of the presented rankings, the overall result provides some support for the view presented in this thesis but also supports part of the arguments in the common view.

The interpretations of these results are discussed further in the following section.

Chapter 5
Discussion

5.1 Introduction

This chapter will discuss the findings of the research with reference to the research objectives and the findings in the existing research that was discussed earlier. The following discussion is arranged by the research objectives and capped off with a conclusion.

Table 5.1 - Research Objective Recap

Objective 1 - Test the common theory of a linear relationship between equity compensation and risk using regression analysis.
Objective 2 - Test the revised theory that the relationship is nonlinear but can be determined and divided into distinct groupings that exhibit different levels risk management.
Objective 3 - Test the two theories against one another by comparing the individual expected outcomes of the ANOVAs to the actual outcome.

5.2 Results and limitations

The regression analysis found no statistically significant evidence of a linear relationship between managerial equity compensation and corporate risk management.

This leaves two possible conclusions. Either the model is inaccurate or the common theory of a linear relationship is insufficient.

5.2.1. Possible diversification

A possible limitation of the model is the degree to which managers can hedge risk through the use of diversification and thereby limit their exposure to the oil price. In this case, if most of the firm's risk management was on the "operational" level, it would be largely invisible to this model.

However, considering that even for the world's largest oil companies, who would arguable have the largest relative diversification, oil still makes up more than 75% of their earnings[6]. It is thus unlikely that any oil company could diversify to an extent that would significantly limit their exposure to the oil price and still be considered an oil company.

5.2.2. Strength of Governance

Another possible limitation of the model is the degree of governance in the firm. [Lel 2012] shows that strongly governed firms tend to use derivatives to hedge currency exposure while more weakly governed firms tend to hedge more for managerial reasons.

If oil companies are assumed to generally be strongly governed, then it is possible that a linear relationship between equity compensation and risk does exist, but the effects are buffered by the presence of block holders enforcing strong governance. In this case the theory of a common relationship would still be valid, but its effect would be invisible in this case study.

Further research might control for this effect by including measures such as percentage of shares owned by institutional investors to identify block holders.

5.2.3. Composition of Management

A third possible limitation of the model is the composition of stock and option holdings across management also mentioned in (Rogers 2002). The variables in this model expressed the stock holdings and the number of options held by the entire management team, making the implicit assumption that management acts as one.

However, if we assume that half of management hold only options and half of management hold only stocks and that risk management decisions are made by reasonable consensus, then via the common theory of a linear relationship, half of management would have an increased appetite for risk and the other half a decreased appetite for risk. In this theoretical case the incentives from equity compensation

[6] Estimates based on annual reports from Royal Dutch Shell, BP, and ExxonMobil.

would cancel each other out and, while real, the effects would be invisible in this model.

Further research might control for this effect by including measures such as size of management team and dispersion of equity compensation across the team.

5.2.4. Choice of Time Periods

This thesis examined the effect of compensation on the oil/stock correlation over the next three years. This 3-year time period was defined by the author as the best guestimate to detect a possible effect. Changes to this time period would likely be able to alter the results of this research and represents another possible limitation to the accuracy of this model. Future research might attempt a similar analysis across a range of time periods to test for time effects.

5.2.5. Interim Conclusion

The first part of the research found no statistically significant evidence of a linear relation between the constructed variables and, by extension, managerial equity compensation and the risk management. Thus, so far this research runs counter to the common theory of a linear relationship.

The model was of course only unable to disprove that no linear relationship exists, which doesn't rule out the existence of a linear relationship. The coefficients for

The variables number.of.options and restricted.stock.holdings also did point in "the right direction", so in the case of a confounding, omitted variable, a different model might have found statistically significant relationship.

A number of potential omitted variables were highlighted such as governance and management composition; however the lack of evidence still prompted a rethinking of the possible relationship between managerial compensation and incentives which will be discussed next.

5.3 Development of the Revised Model

After the results in the first stage of research, this thesis proposed a revised view on the potential relationship between managerial equity compensation and managerial incentives and, in turn, corporate risk management.

In this revised view, the two first points warrant some discussion.

The first point in the revised view presented in this thesis argued that:

- *For some companies, stocks by themselves may not alter the risk profile of the manager but incentivizes him to align the risk profile of the company to that of his own.*

This argument rests on a number of assumptions about how a manager without any equity compensation and only a base salary would act, compared to a manager with stocks.

In extension of the logic presented in the optimal contracting model by [Tirole 2006], an agent with base salary only, will exert no extra effort towards additional risk because even if successful, he receives no extra personal benefits. In reality, a manager will likely be inclined towards additional risk, even without stock and option incentives, due to more implicit, non-financial reward prospects such as gains in reputation, job security and corporate benefits such as nicer offices and corporate jets (Hirshleifer 1993).

However, this proposition rests on the assumptions that managers gain more from good results than they lose from bad results due to informational asymmetry [Bertrand 2001]. With no informational asymmetry, failure would likely result in a similar loss of benefits. As a consequence, the manager would not increase risk unless he is risk-seeking as he is now equally exposed to upside and downside. In other words, he would only take on whatever risk aligns with his own preference for risk.

The argument that stocks make managers more risk averse relies on the assumption that managers now have something to lose because of their financial downside in the face of bad company performance.

However as per the argument above, in the face of symmetrical pay-offs and no information asymmetry, the manager will only alter risk to the extent that fits his risk profile.

Hence, since stocks offer symmetrical pay-offs and, if anything, reduces informational asymmetry, this thesis proposes that stocks by themselves may not alter the risk

profile of the manager but only incentivize him to align the risk profile of the company to that of his own.

Options on the other hand can have incentive-altering effects because they have the potential for asymmetrical payoffs. Hence the second point in this thesis' proposition:

- *The incentive-altering effect of options decrease the further it moves into the money. When deep in-the-money, options behave the same as stocks with the addition of magnifying his behavior due to the increased sensitivity to price changes if he also holds stocks.*

Because of these asymmetrical payoffs, under the right circumstances they can induce a manager to take on extra risk on behalf of the company because he doesn't share in that risk (at least financially). One can of course argue that even under these circumstances, options still do not alter his risk profile either, since his preference for risk hasn't changed, only his exposure to it. However for simplicity's sake this thesis will refer to the effect of options as incentive-altering since they do alter the manager's incentives on behalf of the company.

5.4 Testing of the thesis proposition vs. the common view

As presented in the analysis section, following the initial research results, this thesis proposed a revised view on the potential relationship between managerial equity compensation and managerial incentives and, in turn, corporate risk management.

The subsequent statistical tests, comparing the expected rankings from each view to the research outcome, provided only inconclusive results (illustrated below again for ease of reference).

Table 5.2 - Group Ranking Recap

Ranking Comparison		
Common theory	Thesis Proposition	Result
High Options, Low Stocks	Low options, low stocks	High Options, High Stocks
High Options, High Stocks	Low Options, High Stocks	Low Options, High Stocks
Low options, low stocks	High Options, High Stocks	Low Options, Low Stocks
Low Options, High Stocks	High Options, Low Stocks	High Options, Low Stocks

The conclusion of the analysis section was that the overall results lend the most support to the view proposed in this thesis as several of the significant group differences undermines the rationales of the common view while falling in line with the view presented here.

However these results also rely on a number of assumptions regarding the data used. Primarily, the data assumes that the higher the number of options held, the more of them will be in-the-money. If the assumption instead was that all options were somewhat near the money, then the expected outcome for both the common theory and the view proposed here would be near identical. However, given that stocks and options a generally awarded on a continuous basis, the assumption that the majority of options would be near the money seems a lot less likely than the alternative. Hence the original assumption was deemed reasonable.

Secondly, the proposition that the High Options/High Stocks group was placed as the most risk-seeking was because the most risk-seeking managers negotiating the most equity compensation can also be debated. This problem is also mentioned in (Rogers 2002) and ultimately further insights into the drivers behind the high risk associated with simultaneously high stock and options holdings are needed.

5.4.1. Theoretical Implications

If the revised view proposed in this thesis is in fact a more accurate description of how managerial compensation may affect managerial risk management incentives, then an immediate implication is a re-thinking of how optimal contracts are designed.

If the goal is to increase a manager's appetite for risk, then the most intuitive application of these results would be to utilize put-options rather than call options.

This argument is also presented in (Ross 2004). If the incentivizing effect of call options to take on more risk stems from them having no downside, then put-options together with either stocks or call options would be a better tool to achieve this feature in the manager's compensation as they serve as a hedge to all downside exposure.

Where awarding call options together with stocks only increases upside compared to downside, which would be of little use to an already risk-averse managers, put options together with stocks or call-options or a combination of both, would actively decreases downside compared to upside.

The figure below illustrates the payoff structure of put options together with stocks while figure 5.2 illustrates the payoff of call options combined with stocks.

Figure 5.1 - Stocks and Put options

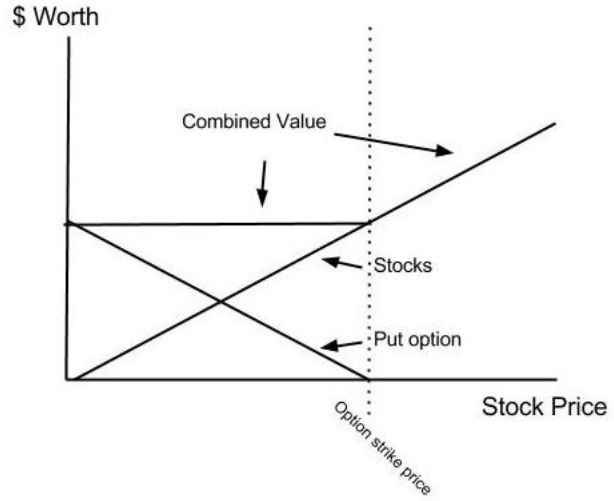
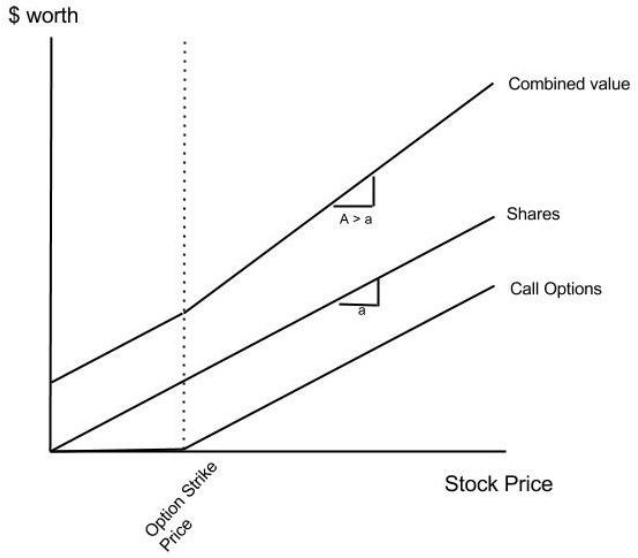


Figure 5.2 - Stocks and Call Options



5.5 Conclusion

This chapter discussed the primary results of the research in this thesis and highlighted what assumptions went into the formation of the revised view proposed in this thesis. It also presented a number of limitations faced by the first stage of research attempting to determine a linear relationship between compensation and incentives toward risk. These limitations however were insufficient grounds to dismiss the lack of evidence of a linear relationship thus prompting the discussion of a non-linear relationship.

The discussion of the results from the final research suggests that a non-linear relationship does exists and lends support to the opposing arguments in the literature and the views proposed by this thesis that option compensation need not always incentive further risk-seeking and that the effect of stocks depend on the situation of the manager.

The following chapter will reiterate the original aim of this thesis before presenting how the individual research objectives were achieved, what limitations this thesis faced and what considerations may go into future research.

Chapter 6
Conclusion

6.1 Introduction

Originally, this thesis set out to contribute to the existing body of empirical research on the linear relationship between managerial compensation and risk management. However, because of the limited evidence in favor of this relationship in the initial stages of research, the assumptions underpinning this view were sufficiently challenged to prompt a rethinking of this relationship.

Accordingly, this thesis sought to build on existing ideas from the opposing arguments in the literature and to propose a revised view in order to explain the relationship between managerial compensation and risk incentives. These ideas we're tested against the Common View of a linear relationship and found an interesting mix of support by instead searching for a non-linear relationship. As such, the final set of research objectives were achieved, each of which are treated below.

Table 6.1- Research Objectives

Objective 1 - Test the common theory of a linear relationship between equity compensation and risk using regression analysis.
Objective 2 - Test the revised theory that the relationship is nonlinear but can be determined and divided into distinct groupings that exhibit different levels risk management.
Objective 3 - Test the two theories against one another by comparing the individual expected outcomes of the ANOVAs to the actual outcome.

6.2 Objectives

Research objective 1 was pursued through a linear regression analysis of the data on managerial compensation and a proxy for corporate risk management. This research found no evidence to support the common view that a linear relationship between the two exists.

Research objective 2 was pursued by categorizing the compensation data into distinct groups and use analysis of variance to test for different risk levels among them. The research found that the level of risk does indeed differ between the groups and supported the theory that a non-linear relationship exists between compensation and risk management.

Research objective 3 was pursued by first establishing the expected rankings among the groups in terms of risk from both the common view and the view proposed here. Then secondly, by comparing these rankings to the actual output this thesis able to find partial support for the opposing arguments in the literature and the view presented in this thesis.

6.3 Limitations and Areas for Further Research

Apart from the limitations discussed in chapter 5, this thesis also faced a number of other limitations. As presented in the literature review, managerial compensation is only one branch of a number of possible explanations behind the extent to which companies hedge. With the large number of other incentives to hedge such as various forms of financial distress and tax schedules, a large number of potentially confounding variables exist. Second, the endogeneity problem persists in this research as well, as compensation may well have been planned in expectation of risky future environments. Thirdly, a lack of insight into the exact composition into the structure of option holdings meant that a number of assumptions had to be made, changes in which may well have had a significant effect on the results of this research.

Therefore, future research may wish to take on the arduous task of collecting primary data on the composition of option holdings and combine this data with a non-linear

model that also controls the many other reasons companies' may hedge such as financial distress costs and tax savings.

6.4 Concluding Remarks

By using a case study method this thesis made some interesting findings in terms of a potential non-linear relationship between managerial compensation and risk incentives. The thesis also suggested a revised view on how to explain this relationship and discussed how to better alter the downside exposure of management.

The author would however like to highlight the argument proposed by (Taleb 2014) and the importance of skin-in-the-game on behalf of the manager.

The optimal compensation contract should encourage calculated risk, not excessive risk.

As pointed out in the literature review, (Breeden, Viswanathan 1998) show that high-quality managers have a higher incentive to hedge in order to lock-in higher profits that are obtained because of their higher ability, while lower ability managers rather gamble, trying to appear like good managers. Removing or significantly reducing a manager's downside would significantly increase the risk of such gambles by bad managers.

It is the view of this author that limiting a manager's downside should be in recognition of the fact that company performance is a result of a complex chain of events, not all of which is within a manager's control, hence warranting a fair risk premium rather than promoting systematic recklessness.

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COMPUSTAT Execucomp database

The Center for Research in Security Prices database

U.S Energy Information Administration database

Appendices

Appendix 1

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	A	B	C	D	E	F	G	H	I
1	Fiscal Year	Company Name	Options Rank	Options Group	Stock Rank	Stock Group	COMBINED GROUP.	Oil.stock sensitivity	
2	1993.1995	ANADARKO PETRC	86	LOW	36	LOW	LOW.LOW	0,899947728	
3	1996.1998	ANADARKO PETRC	110	HIGH	98	HIGH	HIGH.HIGH	0,557306405	
4	1999.2001	ANADARKO PETRC	178	HIGH	77	LOW	HIGH.LOW	0,284752203	
5	2002.2004	ANADARKO PETRC	185	HIGH	85	LOW	HIGH.LOW	0,277558887	
6	2005.2007	ANADARKO PETRC	114	HIGH	155	HIGH	HIGH.HIGH	-0,068107605	
7	2008.2010	ANADARKO PETRC	154	HIGH	170	HIGH	HIGH.HIGH	-0,216589657	
8	2011.2013	ANADARKO PETRC	168	HIGH	179	HIGH	HIGH.HIGH	0,375220645	
9	1993.1995	APACHE CORP	57	LOW	25	LOW	LOW.LOW	-0,261100741	
10	1996.1998	APACHE CORP	41	LOW	19	LOW	LOW.LOW	0,449120761	
11	1999.2001	APACHE CORP	87	LOW	37	LOW	LOW.LOW	-0,02679072	
12	2002.2004	APACHE CORP	116	HIGH	51	LOW	HIGH.LOW	0,383497831	
13	2005.2007	APACHE CORP	139	HIGH	133	HIGH	HIGH.HIGH	0,894892197	
14	2008.2010	APACHE CORP	118	HIGH	171	HIGH	HIGH.HIGH	0,650391945	
15	2011.2013	APACHE CORP	52	LOW	182	HIGH	LOW.HIGH	0,908882356	