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CEO Wealth and the Provision of Incentives

An empirical investigation of the determinants of CEO incentives at companies listed on the Oslo stock exchange 1998-2008

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ABSTRACT

Agency theory predicts that optimal levels of executive incentives are influenced by a trade-off between achieving CEO-shareholder goal alignment, and paying the CEO a risk premium. Executives with higher wealth levels and therefore lower absolute risk aversion should demand a lower risk premium for compensation at risk, and thus equity incentives are predicted to be stronger. Regressions are run of CEO equity incentives on wealth, using data on individual wealth from Norwegian tax authorities. For one of two incentive measures used, empirical results indicate that – in line with predictions of theory – higher-wealth CEOs have stronger equity incentives.

PREFACE

I would like to thank my supervisor, Associate Professor Carsten Bienz, for his advice and helpful comments as well as bringing this interesting topic to my attention. Additionally, I would like to thank Professor emeritus Terje Hansen for valuable insights about Norwegian taxes. Lastly I want to thank the Norwegian tax authorities and in particular Arne Nærdal from the *Skattedirektorat* for answering all my questions about the provided data.

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1. INTRODUCTION

This thesis is concerned with agency theory and its predictions about the provision of equity incentives to top-level executives. Among the variables that are believed to influence incentive levels are firm-level variables like firm size, growth opportunities, leverage ratio, and the noisiness of performance measures. Incentive levels are also believed to be influenced by agent-specific variables such as tenure and risk aversion. The influence of CEO risk aversion has seen little empirical testing due to measuring difficulties. Using data on personal wealth from the Norwegian tax authorities, this thesis attempts to establish the link between wealth and incentives. Two studies that have done comparable research on the link between risk aversion and incentives are worth mentioning (Moers & Peek, 2004; Becker, 2006). Moers and Peek use trailing pay volatility to proxy for risk aversion; Becker uses wealth from Swedish tax authorities. Both studies find that incentives are decreasing in the level of risk aversion.

This thesis adds value by providing an extensive literature review on agency theory and the optimal provision of equity-based performance incentives in executive compensation. Moreover, this thesis performs empirical tests, comparable in nature and methodology to tests performed by Becker (2006), while using a new data set for a different country and time period and an extended set of control variables.

Hypothesis

CEO incentives provided by stock and option ownership will be higher when CEOs have more wealth, reflecting lower absolute risk aversion.

Outline

The remainder of this thesis is organized as follows. In section Two the relevant theoretical background will be discussed. The foundations of contracting in the firm as well as related principal-agent concerns are touched upon. Then an introduction is given to incentive theory, and predictions of the effects of risk aversion are examined. Section Three explores prior research and the intuition behind the different dependent and independent variables, as well as control variables that are used in the econometric model. In the Fourth section the data sources are presented and the methodology for the empirical analysis is explained. Additionally, the specific conditions applying to the

Norwegian data set are discussed and descriptive statistics are provided. Section Five presents the results of the empirical tests. Lastly, section Six draws conclusions and offers summarizing remarks.

2. THEORETICAL BACKGROUND

The theory of decision making in the presence of information asymmetry explains how moral hazard and uncertainty can lead to a principal-agent dilemma. It is, however, useful to start the review of the extant literature on agency theory and incentives with a different but more fundamental discussion, which is centered on the work of Eugene Fama and Michael Jensen (1983). They provide the background and perspective for the agency problems that this thesis is concerned with.

2.1 The Separation of Ownership and Control

In two related papers Eugene Fama and Michael Jensen (1983a, 1983b) discuss the fundamental functions and structures of firms. They then link this theoretical framework to theories on the principal-agent relationship. It is commonplace in modern organizations to see a separation of the decision-making authority and the risk bearing function. They state that this is in part because of the benefits of specialization of those two functions, but also because effective ways exist to controlling the agency problem. This is achieved primarily by further splitting up the decision making function. In the typical corporation there are those making actual business decisions (executives), and those monitoring the decision makers (the board of directors). Fama and Jensen (1983b) mention two further mechanisms for separating decision management from control: formal decision hierarchies, and incentive structures that encourage mutual monitoring.

In reality, not all firms separate decision-making from risk bearing. Fama and Jensen (1983a) examine why some organizations actually have the functions of ownership and control combined in the same person, while most large firms have it separated. They state that central contracts in an organization concern two things: firstly, the nature of residual claims; and secondly the decision process. A combination of decision management and decision control in one or a few agents naturally leads to residual claims that are largely restricted to these agents. Residual claims are the claims to net cash flows, which are left after debtholders and employees have been paid. Whether or not it is efficient to combine the two tasks of management and control depends on whether specific knowledge necessary for decision making is concentrated or diffuse.

Small non-complex organizations

Small, non-complex organizations have important and costly-to-transfer knowledge concentrated in only a few agents. Fama and Jensen (1983a) explain that in these firms the combination of decision making and residual risk bearing is efficient because the potential benefits of unrestricted risk sharing and specialization of functions do not outweigh the costs of controlling the resulting agency problems. A downside of this system is that decision makers have to be chosen based on their willingness to bear risk and their wealth constraints. The fact that decision makers are not chosen solely for their decision capabilities leads to inefficiency.

Large complex corporations

In the alternative scenario of a large open corporation with a complex structure, costly-to-transfer knowledge is diffused among many agents in the organization. The benefits of separating the residual risk bearing function from management are larger than the accompanying agency costs. The benefits of unrestricted residual claims, or common stock, are especially likely to dominate when there are important economies of scale in production (Fama & Jensen, 1983b). These can only be achieved in a large organization; and with size comes the need for complex decision hierarchies and specialized decision makers. The large size also increases the amount of risky equity needed, which is attracted most efficiently through the issue of common stock.

Fama and Jensen (1983b) sum up the advantages of having diffuse residual claims, particularly common stock, as follows[1]. Firstly, there is nearly unrestricted risk sharing among residual claimants, enabling much greater diversification than otherwise possible. Portfolio theory implies that this lowers the cost of risk-bearing services. Secondly, risk can be borne by shareholders that are not employees of the firm. Without most or all of their human capital tied to the firm, external shareholders will demand less compensation for bearing risk. Thirdly, having many residual claimants allows for the purchase of organization-specific assets, which would otherwise be too risky. Additionally, it allows for a specialized and professional management team that may be easier to remove than a management group or family with significant stakes in the company. Lastly, the existence of public residual claims will encourage efficient investment decisions according to the market value rule. This is caused by the fact that

[1] See Fama and Jensen (1983b) p.329-331 for references to the related literature.

residual claimants value their investment taking into account the opportunity cost of investing in the market.

The separation of ownership and control has become a frequently used part of corporate governance in many large corporations because of the benefits that can be achieved by specialization. Management is allowed to focus solely on making business decisions and the risk bearing function is taken up by those willing to do so at the lowest cost. Fama and Jensen (1983a) argue that the long and widespread use of this separation can be taken as evidence of the efficiency of such a separation and its effectiveness in helping to control to agency problem.

2.2 Agency Theory

The origins of agency theory can be traced back to Adam Smith (1776), but a concrete and often cited definition comes from the seminal paper by Jensen and Meckling (1976). They define an agency relationship as "a contract under which one or more persons (the principal(s)) engage another person (the agent) to perform some services on their behalf which involves delegating some decision making authority to the agent". In this definition the use of the term 'contract' warrants further attention. A distinction has to be made between agency relationships and relationships based on formalized contracts, even if both concepts may overlap in practice (Schanze, 1987). The main difference between the two is that an agency relationship is more complicated and ambiguous than a relationship based on a formal contract specifying the exact rights and responsibilities of both parties.

Examples of principal-agent relationships are those between society and a firm; between management and subordinates; between stockholders and bondholders; between patient and doctor; or between insurer and insurant (Firchau, 1987). The most prominent, and the focus of this thesis, is the relationship between the stockholders of a public corporation (the principals) and the CEO (the agent). In this type of agency relationship there is often considerable task ambiguity and no simple way of measuring the performance implications of the agent's actions.

Agency theory is concerned with complex environments. Many theoretical concepts from economics and psychology play a role in what is essentially an interaction between people. There are three main environmental conditions to agency problems. Firstly,

agency problems occur in environments with uncertainty. This generates causal ambiguity with respect to the effects of the agent's actions on firm performance. Secondly, the cooperation between principal and agent is characterized by asymmetric information. Because of the expertise and direct involvement in the environment through his job, the agent is better informed about the environment than the principal. Thirdly, the actions of the agent have external effects. His actions do not only influence his own utility but also that of the principal (Spremann, 1987).

There are two types of problems that can arise in an agency relationship. The first is related to conflicting goals between the principal and the agent. The second is concerned with risk sharing between a principal and an agent with different risk preferences (Eisenhardt, 1989). Both problems lead to situations where the agent has incentives to act not in the principal's best interest.

The theory of decision making with asymmetric information is concerned with two related topics: adverse selection, which is an identification problem; and moral hazard, an incentive problem (Milde, 1987). The principal-agent dilemma can been seen as a special case of the broader moral hazard problem, where the source of moral hazard is the infeasibility of the principal to fully monitor the agents actions (Milde, 1987). The monitoring difficulty creates an opportunity for the agent to pursue self-interested behavior at the expense of the principal. If the principal could directly and costlessly observe the actions of the agent, then the agent could be bound to act in the principal's best interest with the use of detailed contracts. This would entail a first-best solution, inducing risk to be shared optimally (Holmström, 1979).

Applying the theoretical concepts mentioned above to the typical case of a CEO-shareholder relationship, we see how the unrestricted nature of residual claims and the separation of the ownership function from the management function lead to an agency problem. Asymmetric information and an uncertain environment make it possible for the CEO to destroy shareholder value by pursuing self-interested behavior like on-the-job consumption or empire building.

2.2.1 Agency Costs

In the simplest scenario a company is owned and run by a single person. As soon as she sells part of the firm to investors, while remaining the principal decision maker, agency

costs are generated by the divergence between her interest and those of the outside shareholders (Jensen & Meckling, 1976). This divergence will grow if the scenario changes from a small closed firm to a large open corporation and it will have correspondingly large implications for corporate governance and CEO incentives. Jensen and Meckling (1976) divide agency costs into three categories: monitoring expenses, bonding costs and the residual loss.

Monitoring Expenses

Monitoring of the agent and her actions is a way to reduce the moral hazard problem. Monitoring costs involve all the costs of structuring and supervising the principal-agent contract. This includes the costs of auditing and other financial control systems, but also value lost due to inflexible budget restrictions. Features of corporate governance like appointing outside board members limit the opportunistic behavior of management. Jensen and Meckling (1976) include the cost of establishing incentive systems as a monitoring expense.

It can be argued that the provision of incentives through executive compensation systems is not really a monitoring expense. Since incentive schemes serve to align the manager's interests more closely with the shareholder's interests, they in fact help avoid monitoring costs and are thus a substitute to monitoring. However, establishing equity-based compensation schemes is costly, and these costs are ultimately caused by the agency dilemma.

Bonding Expenditures

In some cases it will be optimal for the agent to signal her willingness to behave in the shareholder's best interest. She will incur 'bonding' costs through mechanisms like contractual guarantees for independent auditing, standards to limit perquisites, or requirements for shareholder votes on specific issues (Jensen and Meckling, 1976). Wherever such efforts limit the degree of management discretion, opportunity costs are incurred. As shareholders ultimately bear both monitoring and bonding cost, they have no reason to prefer one over the other except where one is more efficient.

Residual Loss

Even though monitoring and bonding efforts serve to increase firm value, they rarely result in full firm value maximization. There is a constant tradeoff between increasing value through reducing undesirable behavior and spending money on monitoring.

Monitoring and bonding cost should be incurred as long as their marginal benefits exceed the marginal costs. After the amount of monitoring and bonding expenditures are optimized, the remaining reduction in shareholder wealth – resulting from the continuing divergence between the agent's decisions and those that would be optimal for shareholders – is defined as the 'residual loss' (Jensen & Meckling, 1976). The cost of this divergence is in the end constrained by the possibility of the owners to sell the firm.

The problem with the above segmentation of agency costs by Jensen and Meckling (1976) is that the first two types of agency costs, the monitoring and bonding costs, are a direct consequence of the attempt to minimize the third type (the residual loss) (Schneider, 1987). Though recursive, this definition should not, however, reduce the usefulness or explanatory power of the concept of agency costs (Schmidt, 1987).

2.2.2 Agency Costs of Debt

A related but separate dilemma that deserves attention here is the agency problem of debt, which concerns the conflict of interest between debtholders and stockholders of a corporation. Agency costs of debt prevent firms from having extreme leverage ratios with only a small amount of total capital provided by a single owner-manager. Jensen and Meckling (1976) define agency costs of debt as the sum of the following three elements.

Firstly, there is the wealth lost due to the incentive effect of high leverage ratios on management behavior. When an extremely large part of the capital in a firm is supplied by debtholders, owner-managers will have incentives to take excessive risk. A high debt level means only a small equity investment is needed for the manager to get a large stake in the company. All of the upside potential is captured by the equity, while the bondholders bear the burden if the firm fails. Jensen and Meckling (1976) show that such incentives lead to a loss in wealth, because the cooperation required for financing the firm generates agency costs.

The second element concerns the monitoring and bonding costs incurred by bondholders and management respectively. Rational bondholders demand compensation for risk in the form of higher returns, implying that all agency costs will be borne by equity holders. These will agree to protective covenants and restrictions of management to reduce risk and thus the cost of debt financing. Besides direct costs,

writing covenants and monitoring management also entails opportunity costs, as limiting management freedom can lead to suboptimal investment decisions. The optimal extent of monitoring and bonding is limited by the marginal benefits that can be achieved from the reduced riskiness of debt.

The third element is bankruptcy costs. When a firm is in financial distress, the issue of priory to claims becomes a problem, making the bankruptcy procedure costly. To the degree that bondholders can make an unbiased estimate of the bankruptcy costs a priori, the costs will again be borne by equity holders.

Overall, agency costs of debt mean a debt issue entails two tradeoffs (Jensen & Meckling, 1976). Issuing debt is optimal as long as the marginal benefits derived from additional investment opportunities exceed the marginal agency costs of debt. Additionally, the marginal agency costs of debt have to be compared to those that would be incurred by selling additional equity, the other major form of financing.

John and John (1993) emphasize the importance of agency costs of debt for executive compensation. They state that in a levered firm, management compensation schemes should not be focused exclusively on aligning CEO incentives with equity holders' interest. Management compensation should also be used "as a precommitment device to minimize agency costs of debt" (John and John, 1993, p.949). When management interests are strongly aligned with those of shareholders, a CEO may be tempted to issue debt and then take on excessively risky projects. In doing so he would shift wealth from bondholders to shareholders, since the limited liability feature of equity holdings protects shareholders in case of bankruptcy.

John and John (1993) stress that agency costs exist not only for equity but for a wide range of contractual relationships both within the corporation and with outside stakeholders. If the potential for agency costs of debt is higher – for instance if the firm is highly leveraged – the amount of CEO equity incentives will optimally be lower. This issue will be addressed in more detail later.

2.3 Incentive Theory

2.3.1 Introduction to Incentive Theory

In his paper on incentives in principal-agent relationships, David Sappington (1991) gives an introduction to modern incentive theory. Incentive theory focuses on tasks that are too complicated or costly to perform oneself, requiring the employment of an agent; thus linking it to agency theory. The basic dynamics of optimal incentive contracts are explained using the analogy of a farmer (the agent) working for a landlord (the principal). The insights derived from this simple model translate easily to the CEO-shareholder relationship in a typical public corporation.

In the setting described by Sappington (1991), a random productivity parameter, here the amount of rainfall, combined with the effort level of the farmer determine the potential productivity of a piece of farmland. The goal of the principal is to induce the agent to maximize his work effort on the land; while the agent suffers disutility from his efforts. This goal divergence forms the basis of their agency dilemma.

Initially, four restrictive assumptions are made, which are later relaxed. Firstly, the random production variable is unknown to both parties before the employment contract is signed. Secondly, both agent and principal are assumed to be risk neutral. Thirdly, the contract is binding and there is no risk of either party reneging or defaulting on the agreement. Finally, production output (the harvest) is publically observable after the employment period is over.

As is typical in principal-agent situations, there is an element of asymmetric information. After the employment starts, but before choosing his effort level, the farmer can observe rainfall. The landlord can only observe the production output, but never either of the inputs.

If the agent's reservation utility (U) is known to both parties, the simplest way to align their interests, is a type of "franchising" contract whereby the agent receives the value of the harvest (V) minus some constant "franchising" fee (F), instead of a fixed salary. Ideally V-F will be an amount equal to or just above the agent's reservation utility. The farmer is now the residual claimant to V and thus has incentives to maximize his effort

level. The only limitation to perfecting the goal alignment is the difficulty in determining a suitable level of *F* caused by the randomness of the rainfall.

Sappington (1991) demonstrates that when the assumptions mentioned earlier are relaxed, it generally becomes optimal for the principal to engage in monitoring of the agent. In addition to that, the optimal contact will involve sharing of profits instead of a pure franchising structure. Below we examine each assumption individually.

The most interesting case to consider is what happens when the farmer's assumed risk neutrality is removed. When the agent is averse to risk he will require payment to compensate for the risk imposed on him by the randomness of the production parameter. To save on this risk premium, the principal will optimally choose to take some of this risk himself. As a result the agent is no longer the sole residual claimant to the harvest profits, and incentives are no longer optimally aligned. Sharing the production risk with the agent can be seen as a form of insurance provided by the principal to the agent. This will cause the agent to exert less effort towards avoiding bad outcomes.

If we relax the assumption of a binding contract between principal and agent, the farmer will be able to cancel his employment after observing true rainfall. This effectively ensures him his reservation utility at all times, as he will only honor the contract and exert effort if rainfall is high enough to ensure he can earn at least U. In order to incentivize the agent to exert effort even when rainfall is poor, the optimal contract in the presence of limited liability restrictions will involve sharing of the total realized returns. Similar to the case of a risk-averse agent, the farmer will have less-than-optimal incentives to work, as compared to a similar case in a world without these frictions.

The same tradeoff occurs when the assumption of homogeneous precontractual beliefs is removed. If the agent can predict rainfall before deciding to sign the contract, he will enjoy similar features of limited liability as when he can cancel the agreement. The optimal solution is again to change from a franchising to a sharing contract.

In all three of the above cases, the franchise agreement that was optimal in the restricted setting becomes inferior to a sharing contract. The franchise agreement either exposes the agent to too much risk or allocates him too much of the profit. The principal has to resort to promising the agent a share of the total output. It is crucial to note that even

though this leads to less than first-best incentives, the contract is advantageous, as "it induces the agent to tailor his effort level to the environment" (Sappington, 1991). If rainfall is higher, the marginal productivity of the agent's efforts increases, and the agent will exert more effort. The surplus gained from his increased effort is shared between the agent and the principal.

2.3.2 Incentives in Executive Compensation Contracts

The optimal approach to dealing with the shareholder-CEO agency dilemma is twofold. The CEO's behavior is influenced through bonding and monitoring activities, and goals are further aligned though performance incentives like equity holdings. The simple farmland analogy that Sappington (1991) provides helps us understand why sharing contracts are theoretically optimal. Compensation contracts provide incentives that reduce the need for monitoring and bonding expenses while a base salary acts as insurance against market forces beyond the CEO's control. The stock price is a convenient and inexpensive aggregate measure of the CEO's performance.

Monitoring and performance incentives are both complements and substitutes. As Holmström and Milgrom (1991) show, an agent should be allowed more freedom in his actions – implying less monitoring – when more of his own wealth depends on corporate performance. Monitoring activities and incentive schemes are costly, and are assumed to have some theoretically optimal levels. According to agency theory, when tasks become more 'programmable', monitoring will be cheaper and the optimal level of incentives is lowered (Eisenhardt, 1989). This explains why CEOs – who have very multidimensional tasks compared to lower-level employees of a company – receive most of their incentives through stock options (Prendergast, 1999). Core and Guay (1999) demonstrate that firms consciously set optimal levels of CEO incentives and use annual stock and option grants to make adjustments when deviations from the optimum occur.

Stock option plans are not only used to motivate managers, but also to attract and retain the most skilled and least risk averse individuals. Hall and Murphy (2002) state that the use of options in executive compensation induces self-selection of better qualified managers into the CEO's office of firms offering steep pay-for-performance. They also emphasize that stock option schemes are only effective in motivating and selecting

managers if the provided equity instruments are strictly non-tradable. CEOs that are able to hedge their exposure do not really have their wealth tied to firm performance.

2.4 Pay-Performance Sensitivity

2.4.1 Testing Agency Theory

Canice Prendergast (1999) surveys the empirical literature on agency theory and distinguishes two approaches to testing its implications. Firstly, there is research that examines whether agents react to incentives. Secondly, there is research that tests whether compensation contracts reflect the predictions of agency theory.

Concerning the first approach, there is considerable proof that in simple jobs where outputs can be measured easily, stronger incentives lead to higher performance[2]. Concerning the more relevant case of the complex job of chief executives, John Abowd (1990) finds evidence that the provision of performance incentives to CEOs in one year is positively related to expected shareholder returns in the next year. Measuring the effects of incentives on market performance is problematic, as stock returns are influenced by investor expectations; and if incentives are already optimal, increasing them will not lead to higher profits (Abowd & Kaplan, 1999). Experiences with management buyouts however, where incentives for executives to work hard are increased dramatically almost overnight, provide a strong indication that equity incentives are indeed important motivators.

Prendergast (1999) argues that the real test of agency theory is in the second approach, where it is tested whether compensation contracts fit agency-theoretical predictions. One of the most influential empirical studies that attempt to test this is that of Michael Jensen and Kevin Murphy (1990).

Jensen and Murphy (1990) determine the average strength of CEO incentives for a sample of US firms in the period 1969-1983. They estimate the elasticity of CEO wealth to changes in the value of the firm and separate this figure into incentives generated by cash compensation, stock options, equity ownership, and dismissal related wealth changes. Of these categories, the strongest incentives are provided by equity ownership. The aggregate figure they provide combines the incentives of a CEO with median

[2] See Prendergast (1999) p.16-17 for references to the related literature.

stockholdings with the average level of CEO incentives from options, cash and dismissal. This yields a measure of value sensitivity of δCEOWealth/δFirmValue = $3.25/$1000. It is examined whether bonuses, which are at the discretion of the board of directors and which may be tied to some performance measure unobserved by the public, could provide additional incentives. As year-to-year changes in bonuses are minimal, this possibility is ruled out. In addition to monetary compensation, managers are affected by non-pecuniary incentives in the form of both rewards and punishments. These are, however, difficult to measure and do not directly motivate a manager to maximize firm value. Non-pecuniary rewards like power and prestige depend mostly on rank, which for CEOs is fixed and thus unlikely to add powerful incentives. Punishments in the form of dismissal or a hostile takeover depend on many political factors and a broader definition of success than equity value maximization. Stable union relations, community involvement and a good reputation contribute to the perceived success of a CEO. These additional success factors can cause managers to take actions that have a negative impact on shareholder value (Jensen and Murphy, 1990).

The view of Jensen and Murphy (1990) is that the incentive levels they find are too low to be consistent with agency theory. One side of their argument is based on the fact that even if the average corporation loses millions, its CEO will only see a small percent decline in his compensation. The other side of the same argument relates to situations where CEOs are considering spending corporate funds on a pet project or personal perquisite. With an elasticity as previously defined of 0.00325, a corporate jet of $10,000,000 will only cost the CEO $32,500. Who could resist such a discount?

In a later publication, the same authors propose that CEOs should face more meaningful and serious penalties following bad performance (Jensen & Murphy, 1991). Executives stay in their position long after it becomes clear that corporate performance is suffering. Reasons for this type of inertia could be, among others, entrenching by the CEO, an illiquid job market for executives, or costs related to severance payments.

2.4.2 Explanations for the Jensen and Murphy (1990) Results

Jensen and Murphy (1990) discuss several alternative explanations for the low pay-performance sensitivities they find. Risk aversion and wealth constraints on behalf of the CEO are considered first. Risk aversion lowers the amount of incentives that are

optimally provided to the agent as he will demand compensation for the risk imposed on him. Wealth constraints imply the CEO is unable to acquire a significant share of the company. Additionally, no CEO would commit to large 'negative bonuses' if performance were extraordinarily poor; and no shareholder would agree to excessively large CEO bonuses that would leave nothing for shareholders, if performance was extraordinarily good. Even though Jensen and Murphy (1990) acknowledge that these issues limit the feasible 'slopes' of incentive schemes, they believe risk aversion and wealth constraints alone do not justify the low sensitivities observed. They argue that the amount of wealth that is really at risk in a typical compensation contract is small. Experience with management buyouts and franchising contracts is taken as evidence that pay-performance sensitivities much higher than the 0.00325 they found are feasible.

Two other possible explanations are presented. Either the CEO is not an important agent of shareholders, or CEO incentives are not important. Experience from stock price reactions following the change of a CEO, as well as documented increases in profitability after management buyouts, rebut these hypotheses. Jensen and Murphy (1990) believe that increased regulation and political forces, both from the public and the private sector, constrain pay-performance sensitivities. Evidence is presented indicating that between the 1930s and the 1980s CEO pay-performance in large US firms fell significantly while overall corporate regulation increased. Regardless of changes in official regulation, executive compensation remains a sensitive topic and the reasonableness of compensation contracts depends on public and political opinions. Pressure from labor unions, the media and consumer groups will therefore make compensation committees reluctant to adopt highly innovative executive compensation practices.

It is argued by John and John (1993) that the low pay-performance sensitivities found by Jensen and Murphy may be due to agency costs of debt. In cases where these costs are potentially high (e.g. the firm is highly leveraged) shareholders will use a system of executive compensation with low equity sensitivity in order to credibly commit not to engage in excessively risky projects that can shift wealth from bondholders to shareholders (Jensen and Meckling, 1976; John and John, 1993). The argument by John and John implies a negative relationship between pay-performance sensitivity and leverage. The authors prove this relationship by comparing the use of straight debt

versus convertible debt in companies' capital structures and the effects on optimal executive compensation schemes. It is found that companies using straight debt have low optimal pay-performance sensitivities, while comparable firms using convertible debt have much steeper pay-for-performance slopes.

2.5 Optimal Incentive Levels

2.5.1 The Effect of Risk Aversion on Optimal Incentive Levels

Jensen and Murphy (1990) are quick to dismiss the importance of CEO risk aversion in the determination of optimal incentive levels. Before this conclusion can be drawn however, it has to be assessed whether the measure of incentives used is actually suited and sufficient for testing the predictions of agency theory. As John Garen (1994) notes, assessing the consistency of empirical findings with economic theory is often complicated by the fact that too much information is needed to draw strong conclusions. In this case, whether a certain level of pay-performance sensitivity is consistent with the principal-agent model depends on many unobserved variables. Important variables include the CEO's production- and utility-functions, risk aversion, and outside disturbances affecting firm performance (Garen, 1994). Without information on all these variables it is impossible to determine with certainty that an empirically determined value of pay-performance is either too high or too low.

Hall and Liebman (1998) argue that a level of δCEOWealth/δFirmValue of \$3.25/\$1000 may actually represent much stronger incentives than implied by Jensen and Murphy (1990), as the denominator in this equation is typically very large. It is argued that because of the large size of the typical listed corporation, the sharing rate is not an appropriate measure for judging whether incentives are optimal. Related to this argument, Sherwin Rosen (1990) criticizes the fact that Jensen and Murphy (1990) use arithmetic differences instead of log differences, as arithmetic effects will naturally decrease in larger firms where the value at risk is higher.

An alternative strand of research has replied to the results of Jensen and Murphy (1990) in a different way, attempting to show that their findings need not be inconsistent with formal models of agency theory. Haubrich (1994) provides numerical calculations that show that principal-agent theory, given reasonable assumptions, can predict values of

pay-performance of the same order of magnitude as the empirical evidence. He also shows that even low levels of pay-performance can provide significant incentives and result in an increase in firm value. The model used by Haubrich also confirms that risk aversion can considerably influence levels of pay-performance sensitivity. Haubrich and Popova (1998) similarly show that formal agency models can do a reasonable job of explaining the data from Jensen and Murphy (1990) and that empirical incentive levels may be close to the optimum as predicted by theory.

Hall and Liebman (1998) underline the importance of CEO risk aversion and wealth constraints as variables needed to make judgments about empirically determined incentive levels. The importance of accurate risk aversion estimates has continuously been stressed by several scholars like Eisenhardt (1989), Holmström and Milgrom (1991), Abowd and Kaplan (1999) and Moers and Peek (2004). Research by Parrino, Poteshman and Weisbach (2005) suggests that too high CEO risk aversion can significantly distort management decision making, as it leads managers to avoid high-risk projects, even if they have a positive net present value. As the importance of risk aversion for incentives in the agency-theoretic model becomes clear, attention must shift to the issue of whether there is enough measurable variability between agents to empirically prove that incentives vary with risk aversion.

2.5.2 Limits to Incentive Levels

The idea that executive incentive levels have some optimum which depends on certain variables is theoretically appealing. Too strong or too weak incentives will lead to distortions in executive decision making and thus lower corporate performance.

The implications of low equity incentive levels are a lack of motivation and a sub-optimal focus on maximizing the share price. If the principal wants to increase the agent's incentives, the incentive effects have to be traded off against the risk premium the CEO will demand for accepting riskier compensation. The benefits from increasing low incentives are limited by the fact that, while CEOs will always put higher values on more equity compensation than on less, this happens at a decreasing rate. When the CEO receives more of her firm's equity, her wealth will become increasingly less well-diversified. The value of stock and option grants as perceived by the CEO is always lower than the cost to shareholders because of suboptimal portfolio diversification (e.g.

Lambert, Larcker & Verrecchia, 1991; Hall and Murphy, 2002). Abowd and Kaplan (1999) find that corporate boards have to increase the total value of CEO compensation by an average of 36% if they want to increase the percentage of stock-based compensation from 0% to 20% of total compensation. Similarly, Hall and Liebman (1998) find that stock based compensation has half the certainty equivalent of cash. Without the incentive effects, stock and stock options are a very costly and inefficient form of executive remuneration.

Other potential problems related to high incentive levels are an excessive focus on short-term stock market returns and earnings management. Ross (2004), however, opposes the view that options always increase the manager's willingness to take risk, and argues that other effects like the wealth effect of options have to be taken into account. Garen (1994) also stresses that higher CEO inside ownership, implying low diversification of his wealth, can incentivize the CEO to invest in projects that have too little risk and too low returns.

2.6 Prior Empirical Research on the Effect of Risk Aversion

Two recent papers investigate empirically the relationship between risk aversion and incentive levels. These will be discussed in turn.

2.6.1 Moers and Peek (2004)

Moers and Peek (2004) empirically examine the effect of risk aversion on the use of CEO pay-for-performance. They identify two proxies for risk aversion. For their first proxy variable they use the variance of the agent's cash compensation. As a risk averse agent prefers less to more risk, this should be low when risk aversion is high. For the second proxy the authors use the mean level of cash compensation divided by the variance of cash compensation. As a risk averse agent will demand a risk premium, this should be high when risk aversion is high. Incentive levels are measured as the sensitivity of cash compensation with respect to both accounting and market performance. Cash compensation is used in favor of total compensation in order to exclude equity holdings, as the value of these holdings is likely to be negatively related to the agent's risk aversion. They argue that the variance of the total compensation would be an inaccurate measure of variance as perceived by the CEO. Two main firm-level control variables are

employed: the growth opportunities of the firm (using the market-to-book ratio) and the noisiness of the accounting and market performance measures.

Moers and Peek find that executive compensation is less variable for higher levels of managerial risk aversion. This supports the notion that a very risk averse agent requires only low pay-for-performance incentives.

2.6.2 Becker (2006)

Bo Becker (2006) recognizes that many CEOs of large companies get remunerated in the form of risky instruments. He states that risk aversion on the side of the agent should decrease the value of these instruments to the recipient and the riskiness of the compensation should lead to lower optimal levels of incentives. Becker uses CEO wealth to proxy for risk aversion.

Using data from Swedish tax authorities on the wealth of a panel of Swedish CEOs from 1993 to 1999 he examines whether wealth has a positive effect on incentive levels. He finds that CEOs with larger wealth – and thus lower risk aversion – indeed have significantly larger incentives. Becker uses both value sensitivity ("Share-of-the-company") and return sensitivity ("Money-at-stake") to measure incentives. The level of CEO inside ownership is calculated by dividing the total value of the CEO's stock and option holdings by the total market value of firm equity.

In his regressions, Becker controls for firm-specific and agent-specific effects like firm size and CEO tenure. He further investigates the hypotheses that the wealth figures in his sample capture other features like CEO skill or corporate power. There are indications that these hypotheses may hold some validity, but it remains safe to conclude that wealth has a positive effect on incentive levels.

3. VARIABLES

This section first discusses methods of measuring incentives used in prior research. It then continues to cover the topic of CEO risk aversion, as well as the theoretical foundation behind many of the included control variables.

3.1 Incentives

The motivation of a CEO to maximize firm value is affected by incentivizing effects beyond purely monetary items. Personal drive, pride, career development, threat of dismissal and other factors play a role. Incentives that are relevant to this study however, are those pecuniary amounts provided to managers and paid for by shareholders that have as a goal to induce the CEO to attempt to maximize shareholder value. Total compensation consists of many pecuniary and non-pecuniary elements including salary, long-term bonus schemes, status, perquisites, and pension plans. The incentive effect stems from compensation that is contingent upon firm performance. Jensen and Murphy (1990) create an incentive measure from cash compensation, bonuses, stock options and the threat of potential dismissal. In this thesis I will include only incentives from equity-based instruments, following the approach used by Becker (2006). This method is used because equity-based incentives provide a direct, objective and transparent link between CEO wealth and shareholder wealth. As Jensen and Murphy (1990) show, stockholdings and options account for the bulk of total CEO incentives.

3.1.1 Value vs. Return Sensitivity

To measure incentives from equity-based instruments there are two main approaches, which were already briefly touched upon in section 2.6 above. Return sensitivity (δCEOWealth/δStockReturn) assumes that incentives depend on the CEO's dollar stake in the firm's equity and is calculated simply as the total *monetary* value of CEO inside equity holdings. The alternative assumption, underlying value sensitivity (δCEOWealth/δMarketValue), is that incentives increase with the CEO's *percentage* ownership of company's equity. It is computed by dividing the value of CEO holdings (the former measure) by the total value of firm equity, resulting in the fractional ownership of the CEO.

Jensen and Murphy (1991) argue that measures that focus on the dollar value of stockholdings or on the ratio of equity-to-cash compensation are less relevant than a measure of ownership percentage, which provides the most direct feedback effect. If CEOs hold a high percentage of company stock they will think twice about wasting money on a pet project or corporate fleet (Jensen & Murphy, 1991). Baker and Hall (2004) investigate the relationship between CEO incentives and firm size. They argue that the choice of which incentive measure is more appropriate will depend on the type of CEO activity under consideration. When an executive is contemplating the purchase of a corporate jet the dollar impact is constant regardless of firm size. Here the percentage ownership variable, yielding a dollar-on-dollar measure, is most appropriate. When deciding on corporate restructuring the dollar amount may depend strongly on firm size, while the percentage impact is similar for firms of differing sizes, thus making return sensitivity the more appropriate variable. Both incentive measures will be used for analysis in this thesis.

3.1.2 Incentives from Stock Options

When measuring equity incentives it is important to include incentives from stock options. Option contracts awarded to executives are typically at-the-money call options. They add incentives similar to equity in that their payoff depends on the future stock price. John Core and Wayne Guay (1999) explain that while incentives from stockholdings are easily calculated, the incentive effect of stock options is more complex because option values do not move one-to-one with the share price. Many parameters defined in the option contract determine the sensitivity of the option to changes in the stock price. This sensitivity, known as the option delta, is the partial derivative of option value with respect to share price. Core and Guay (1999) note that the typical delta for a newly issued long-term option is approximately 0.75. Baker and Hall (2004) use a value of 0.7 while Hall and Liebman (1998) and Becker (2006) use 0.6. In this thesis I follow the latter approach in assuming a standard option delta of 0.6.

A computation of option values following the approach pioneered by Black and Scholes (1973), which scholars like Yermack (1995) and Core and Guay (1999) advocate, is methodologically complicated by the fact that often many details about executive option awards are not made public. Additionally, as Hall and Murphy (2002) show, the Black-Scholes value of an option represents its true value only for the holders of a well-

diversified stock portfolio, free to trade and hedge at will. But when added to the highly undiversified and partially restricted portfolio of the typical CEO, the same option is worth much less because of the large amount of non-systematic risk. The risk premium that has to be paid to the CEO makes options a very inefficient form of remuneration. Hall and Murphy (2002) believe that in practice part of this inefficiency may be offset by the favorable accounting treatment of options.

With respect to measuring stock option values from the CEO's perspective, Hall and Murphy (2002) argue for the use of 'certainty equivalent' values that in addition to the standard option parameters depend on diversification, risk aversion and initial wealth levels of the CEO.

3.2 Risk Aversion

As noted in section 2.5 there are many scholars that stress the importance of risk aversion for executive compensation and optimal incentive levels. There is, however, no easy way to directly measure or obtain data about the risk aversion of specific individuals. Scholars have therefore used several different ways to estimate or proxy for risk aversion using publicly available sources of information.

3.2.1 Approaches to Measuring Risk Aversion

Moers and Peek (2004) develop two variables that proxy for risk aversion. They are based on the reasoning that a risk averse agent prefers less to more risk and when confronted with risk, will demand a risk premium. They infer that risk aversion should be closely related to, firstly, the variance of compensation; and secondly, mean compensation divided by the variance of compensation. They argue that the variance of compensation should be lower for more risk averse agents, since they prefer less to more risk. The variable of mean compensation divided by the variance of compensation is predicted to be increasing in risk aversion as a more risk averse agent will demand a higher risk premium.

Moers and Peek (2004) validate their proxy variables by testing whether business risk is lower in firms with high risk aversion CEOs. Business risk is measured by looking at industry-adjusted values of beta, leverage and foreign currency exposure. Their results

indicate that firms with high risk aversion CEOs indeed tend to be the same firms that have low business risk, confirming the validity of their risk-aversion proxies.

Abdel-Khalik (2007) uses two alternative ways to measure risk aversion, based on previous research[3]. The first way involves looking at a group of individuals and how they choose to divide their personal capital between two investments classified as *safe* and *risky* respectively. This results in an estimate of risk aversion relative to the reference group.

The alternative way to measure risk aversion is using individual demographic characteristics. Income, wealth and education, for example, are taken to have a negative effect on risk aversion, while being female and older increases risk aversion. Abdel-Khalik (2007) uses age, tenure, percentage ownership and estimated wealth to derive an implicit, *latent* CEO risk aversion variable. This variable predicts the degree to which a CEO would be willing to accept risky pay-for-performance instead of safe fixed salary. He also estimates this risk aversion variable more directly by looking at the actual ratio of variable to fixed pay in existing CEO compensation contracts. This observed ratio may however be influenced by things other than the CEO's preferences, like the labor market or corporate governance policies.

3.2.2 CEO Wealth as a Proxy for Risk Aversion

The approach to measuring risk aversion as pioneered by Becker (2006) is to use a proxy variable based on government-issued data on individual's taxable wealth. While this approach is infeasible in most countries, the tax authorities of Sweden and Norway make this data publicly available on an annual basis.

It is likely that wealth can be a reasonable risk aversion proxy, as it is generally assumed that higher-wealth individuals have lower levels of absolute risk aversion (eg. Eisenhardt, 1989; Baker and Hall, 2004; Hall and Murphy, 2002; Becker, 2006; Abdel-Khalik, 2007). The relationship between wealth and risk aversion can be shown in the following way. The Arrow-Pratt definition of absolute risk aversion (Pratt, 1964) is

$$R_A = -\frac{u''(w)}{u'(w)}$$

[3] See Abdel-khalik (2007) p.5 for references to this literature.

Where u(w) is a utility funtion of wealth.

Relative risk aversion is subsequentially defined as

$$R_R = -\frac{wu''(w)}{u'(w)}$$

Equivalently, absolute risk aversion is equal to relative risk aversion divided by wealth:

$$R_A = \frac{R_R}{w}$$

If it is assumed that all CEOs have similar levels of relative risk aversion, and that they have the same utility over wealth, then the degree of absolute risk aversion will be negatively related to the size of the individual's wealth endowments (Baker and Hall, 2004; Becker, 2006; Abdel-Khalik, 2007). For CEOs that are richer, u''(w) will be lower in absolute terms, meaning they will be able to tolerate more risk and also require greater incentives to exert effort (Becker, 2006).

This thesis assumes a logarithmic form utility function for the CEOs in the sample. This implies constant relative risk aversion and decreasing absolute risk aversion. A CEO with more wealth will have lower risk aversion than a CEO identical in terms of relative risk aversion but with less wealth (Becker, 2006).

3.3 Control Variables

This section describes other variables that are also believed to have an influence on incentive levels. Behind these variables are many interesting forces and diverse strands of research. Previous studies are discussed here and they will also guide sign expectations for the econometric regression analyses. The main aim of including these variables is to control for these effects as best possible so as to isolate the effect of risk aversion.

3.3.1 CEO Age

In addition to the level of CEO wealth and income, two further CEO-specific variables are included in the analysis, namely age and tenure. Previous empirical research on the effect of CEO age on incentives is mixed.

David Yermack (1995) tests the 'horizon problem' hypothesis in his empirical work on the pay-performance sensitivity from yearly stock option awards. His definition of pay-performance is similar to the one used by Jensen and Murphy (1990). It is, however, different from the approach used in this thesis, where total equity incentive levels are taken into consideration and not just yearly option awards. Yermack states that CEOs that are near retirement, as proxied by their age, should have a tendency to under-invest. Accounting-based incentive plans punish the CEO for current spending, while future CEOs reap the benefits of the investment. To compensate for this problem, older CEOs should receive more long-term equity incentives, but Yermack finds no empirical proof to support this hypothesis.

Earlier empirical work by Gibbons and Murphy (1992) describes incentive contracts when workers have career concerns. Career concerns imply that employees that are closer to retirement worry less about their reputation as it is already set, meaning their current performance has less effect on future compensation. Effort levels are therefore expected to decline with age and tenure. Gibbons and Murphy find evidence to support the hypothesis that keeping tenure constant, the slope of the compensation contract is steeper the closer the CEO is to retirement. Research by Garen (1994) on the determinants of pay-performance and equity incentives also finds that age has a positive effect on incentive levels.

To the contrast, Becker (2006), using a more similar approach to the one used in this thesis, finds a negative influence of age on incentives, although results are statistically significant for only one of two incentive measures used.

3.3.2 CEO Tenure

In standard agency theory, the longer an agency relationship lasts, the more the principal will learn about the agent's abilities and behavior. This reduces the information asymmetry between the two parties and thus less incentive pay is required to keep goals aligned (Eisenhardt, 1989). To the degree that this applies to CEO-shareholder relationships, we should observe a negative relationship between CEO tenure and incentives. This seems not to be the case though, as it is typically observed that CEOs with longer tenure have more equity and stock options (Baker & Hall, 2004). Longer experience in the position of CEO increases the executive's human capital and

also his potential impact on corporate performance, which is associated with higher equity incentives (Gerhart & Milkovich, 1990).

Bushman, Indjejikian & Smith (1996) investigate the role of individual performance evaluation (IPE) in CEO compensation. They hypothesize that CEOs with low tenure are evaluated more on their individual performance and less on the company's market performance, as market performance will be driven largely by the efforts of preceding CEOs. However, their empirical tests show that the importance of IPE in total evaluation actually increases in tenure. It is conjectured that a longer serving CEO is more entrenched in his position and able to exert more power over the board of directors. As individual performance assessment is easier for the CEO to manipulate, he will use his power to increase the percentage of IPE in his total compensation. This may indicate that as IPE becomes more important, market-based incentives decrease. As the measures of incentives used in the research by Bushman et al. (1996) are not absolute values but relative to total compensation, the results cannot be readily compared to the analysis in this thesis.

Other empirical research by Gibbons and Murphy (1992) is supportive of the idea that higher tenure CEOs are given more contingent pay, even though the study is unable to provide significant proof of this relationship. Core & Guay (1999) do provide evidence of a positive relationship between tenure and incentive levels. Their argumentation follows Gibbons and Murphy (1992) and is counter to that of Kathleen Eisenhardt (1989). On one part, they do agree with Eisenhardt that uncertainty about the CEOs abilities is reduced over time. They then argue though, that this reduces the CEOs exposure to risk caused by market forces beyond his control, making it possible to increase both equity incentives and goal alignment. The research of Core and Guay (1999) gives an indication of the effects of tenure on incentives and the intuition behind it. However, as Core and Guay focus on newly awarded option grants and not total existing equity incentive levels, their analysis differs methodologically from the analysis presented in this thesis. The study by Becker (2006) is more comparable in nature and it documents positive effects of tenure on incentives, though statistical significance is weak.

3.3.3 Firm Size

The size of the firm, as measured by either sales or market value, should affect the dynamics of equity compensation to a CEO as personal wealth constraints prevent CEOs of large firms from owning a high percentage of total equity. Levels of δCEOWealth/δFirmValue in the study by Jensen and Murphy (1990) are more than four times lower in the top half of their sample - ranked by market value - than in the bottom half.

Bizjak, Brickley and Coles (1993) and John Garen (1994) perform empirical tests of the effect of firm size on incentives; both papers find a negative relationship. Scott Schaefer (1998) finds that pay-performance sensitivity is inversely related to the square root of firm size. These studies are in line with the agency theoretic tradeoff of risk versus incentives. Without the effects of risk aversion and wealth constraints, company size should have no influence on the level of CEO's equity incentives.

The documented effect of firm size need not imply that CEOs in large firms have too low incentives, as the total personal value at risk for the CEO can still be very large and may represent a significant part of his total wealth. Baker and Hall (2004) establish that while incentives as measured by percentage ownership decrease in firm size, the value-at-risk measure increases significantly. The combined effect of company size on CEO incentives is a product of pay-performance sensitivity and the marginal product of the CEO's effort. Baker and Hall document that this combined effect stays more or less constant as firms become larger. It is stressed that lower pay-performance in large firms does lead to a greater agency dilemma and thus necessitates more monitoring, especially concerning CEO actions with a fixed dollar impact. It is, however, unjust to conclude that incentives are too low in large firms just because pay-performance ratios seem low.

Two studies have found evidence of a size effect counter to the predictions of agency theory. Measuring company size using the log of total assets, David Yermack (1995) in his empirical research on stock option awards finds weak evidence that bigger firms use more options. He conjectures that large firms face more difficulties monitoring executives, and have more willingness and resources available for executive stock option plans. The research by Core and Guay (1999) uses a similar approach and finds a

positive relation between the logged value of firm equity and incentives. Here it is argued that bigger firms require more talented CEOs and are willing to offer higher fixed compensation as well as more equity incentives to attract the most skilled CEOs. It should be noted again that both these papers examine annual option grants and not total levels of equity incentives.

3.3.4 Agency Costs of Debt

Section 2.2 described agency costs of debt, which are caused by a conflict of interest between debtholders and stockholders of a firm, and are made up of a combination of monitoring expenses, the costs of financial distress, and the negative incentive effects of leverage (Jensen and Meckling, 1976). It was argued by John and John (1993) that because of this agency dilemma, highly levered firms will optimally provide lower equity incentives to their CEOs. Executive compensation should be used as a 'precommitment device' signaling to prospective bondholders the intention not to engage in risk-shifting activities. In line with results from earlier empirical research[4], John and John (1993) prove that pay-performance sensitivity decreases in the debt-to-equity ratio. Recent research from Billett, Mauer and Zhang (2008) also yields findings that are consistent with this theory. Garvey and Mawani (2005) show that the widespread practice of granting stock options at-the-money may help reduce potential agency costs of debt.

3.3.5 Firm Risk

An important firm-level variable is the riskiness of the company stock. Standard agency theory states that increased uncertainty in the measure of performance – like a more volatile stock price – should lead to lower optimal incentives (eg. Eisenhardt, 1989; Prendergast, 2002; Becker, 2006). However, as Prendergast (2002) notes, conclusive empirical evidence of this relationship is scarce.

In general cases of principal-agent relationships between managers and employees, higher degrees of task delegation and freedom of the agent are observed where uncertainty is higher. Performance measurement is more likely to rely on observed output than on hard-to-observe effort input (Prendergast, 2002). Delegating an action to an agent is only optimal if you pay based on observed output. Otherwise the agent chooses the action with the highest private benefit. The purpose of performance pay is

[4] See John and John (1993) p. 952 for references to this research.

not to increase effort per se but to incentivize the agent to spend his effort the *right* way. This argument was illustrated earlier using the example David Sappington (1991) offered (see part 2.3 above).

Several papers investigate the influence of firm risk in a principal-agent setting. It is important to differentiate between accounting-based and market-based measures of risk. Lambert and Larcker (1987) compare the use of accounting and market measures of performance in cash compensation of executives. They find that CEOs receive relatively more market-based compensation when the variance of accounting-based measures is high compared to that of market measures. David Yermack (1995) reaches the same conclusion: greater noisiness of accounting measures complicates monitoring of the CEO, so stronger market-based incentives are needed. The level of uncertainty and noise in performance measures can essentially proxy for monitoring costs.

Based on a review of the then existing literature, Eisenhardt (1989) proposes that the amount of performance pay relative to fixed wages is negatively related to outcome uncertainty. Holmström and Milgrom (1991) derive a negative relationship between the agent's ownership of assets and the variance of the return on those assets. Similarly, Garen (1994) shows that – as predicted by agency theory – a higher variability of firm profits reduces pay-for-performance in favor of less risky salary components, though parts of his empirical results have only low statistical significance. Bushman et al. (1996) hypothesize that the amount long-term executive compensation compared to base salary should be decreasing in the variance of the stock price, but no statistically significant relationship is found. Mishra, McConaughy and Gobeli (2000) are able to empirically show that riskier firms should use less incentive pay as compensation based on highly risky stock returns exposes the CEO to too much personal risk to make optimal decisions. More recent research further supports the importance of total firm risk for management decision making (eg. Parrino et al., 2005).

Aggarwal (1999) finds that CEO pay-performance sensitivity is negatively correlated with the variance of the firm's stock performance. This implies that CEOs of high-risk firms own a smaller percentage of the firm’s equity. Core and Guay (2002) pose a critique to the measure of risk used by Aggarwal – the dollar return variance – as it can be interpreted as a noisy proxy for firm size. They argue for clear separation of the effects of size and risk and believe that a positive relationship between uncertainty and

ownership incentives should exist when size effects are controlled for. They are unable to provide empirical proof however, as their alternative risk proxy of 'percent return variance' yields a positive coefficient which is counter to their predictions. It is conjectured that this variable may instead proxy for the degree of superior information of managers over shareholders.

3.3.6 Firm Liquidity

David Yermack (1995) poses that the provision of stock options to CEOs might be used as a method of saving cash. He hypothesizes that firms with liquidity problems will provide a greater fraction of CEO compensation in the form of stock options as opposed to cash. He identifies companies with liquidity constraints by looking at their pattern of dividend payments and finds evidence to support his hypothesis. However, Yermack notes that these results must be interpreted with caution, as CEOs with significant holdings of stock options have incentives to reduce dividend payments, thereby increasing the value of their options.

3.3.7 Firm Growth Opportunities

Several scholars have investigated the link between firm's growth or investment opportunities and the provision of equity-based CEO compensation. The majority of this research supports the notion that larger growth opportunities make equity-based pay more attractive and therefore more frequently used for executive compensation. Most studies use the ratio of market-to-book values (MTB) of a company as proxy for growth opportunities.

Lambert & Larcker (1987) for instance find that firms use more market-based methods of evaluating CEOs, compared to accounting-based measures, when the firm's assets and sales are experiencing high growth rates. In their paper about individual performance evaluation Bushman et al. (1996) document that the use of IPE relative to accounting- or market-based measures increases with growth opportunities. No conclusions are drawn about the absolute amount of market performance measures in relation to growth opportunities.

The study by David Yermack (1995) includes a variable that is very similar to the market-to-book ratio. Yermack conjectures that stock option awards should be

increasing in this MTB variable, but he finds no evidence to support this. In a survey of comparable studies he finds that most scholars performing similar analyses do find a positive relationship between growth opportunities and stock option awards[5]. The only paper documenting a significant negative relationship is by Bizjak et al. (1993) who use both the MTB ratio and the firm's research expenditures as proxies for growth opportunities. The authors are unable to explain the finding that pay-performance sensitivity is decreasing in the amount of growth opportunities. Later studies that perform similar analyses of growth opportunities based on the market-to-book ratio (Core & Guay, 1999; Moers & Peek, 2004) expect and find a positive relationship.

3.3.8 Industry Regulation

There is evidence that variation between industries of the amount of government regulation may have a pronounced influence on the levels of CEO pay-for-performance. David Yermack (1995) documents that highly regulated industries are less likely to use stock options for management remuneration. Following Joskow, Rose and Shepard (1993) he hypothesizes that in highly regulated industries the discretion of the CEO is limited, leading to a reduction of the marginal impact of the CEO's efforts. Using the approach of Smith and Watts (1992), Yermack shows that CEOs in utilities and insurance companies have lower incentives. Other scholars like Bizjak et al. (1993) and Baker and Hall (2002) also provide proof for this negative relationship between industry regulation and equity incentives.

[5] See Yermack (1995) p.241 for references to these studies.

4. DATA AND METHODOLOGY

This section first describes the tax conditions in Norway and then presents the sources of data used as well as descriptive statistics for the variables. In addition, methodological issues and the regression analysis approach are covered.

4.1 Personal Taxes in Norway

This thesis attempts to provide a measure of individuals' risk aversion using data on personal wealth levels. Norway is known to have one of the highest average wage levels in the world. Norwegian gross domestic product per capita was 2.7 times the EU average in 2009 (International Monetary Fund, 2010). The country also has very high wage equality, with a reported Gini index of 25 in 2008 (Central Intelligence Agency, 2010). The ratio of CEO wages to average wages is much lower in Norway than in other countries. These special features make it hard to translate results to other countries. The investigation of the relationship between risk aversion and incentives, however, is still valid.

The tax authorities in Norway provide information on taxable wealth and income of tax payers on an annual basis. Norwegian law requires this information to be made publicly available. Tax filing for individuals in Norway is largely automated. Employers, social security authorities, banks, insurance companies and other institutions provide the tax authorities with information on the income and assets of residents. Taxable wealth is computed from assets such as cash, real estate, cars and equity holdings.

An important caveat when studying taxable wealth is that tax values of assets are often much below their actual market values (Skattedirektoratet, 2009). Real estate for instance is rarely valued at more than 30% of market value. For valuing stockholdings of unlisted companies, book values are used, which are also usually below market values. Cash and cash equivalents as well as all listed equity instruments are valued at 100% of year-end market values. Mortgages and other debt are deducted from gross wealth.

In many cases the deduction of multiple mortgages, underreporting of offshore wealth, and other forms tax evasion cause an individual's taxable wealth to be driven down to zero. The issue of tax evasion creates noise in the wealth data and makes conclusions about real market values of wealth impossible. To the extent that it can be assumed that

all CEOs evade taxes to more or less the same degree and that tax evasion is constant over time, data from different CEO-year observations can still be compared. However, as much as 32% of all observations in the sample feature zero taxable wealth, indicating that conclusions based on these reported figures will have to be interpreted with caution.

In order to increase the explanatory power of the data provided by the tax authorities, the level of taxable income is also included in the analysis. As it is much harder to evade taxation of income than it is to evade taxation of wealth, this figure will lie closer to true market values than in the case of wealth. As wealth and income are usually strongly correlated, combined information about taxable income and wealth may provide a better proxy for the risk aversion of the CEO than data on taxable wealth alone.

4.2 Data Sample

The sample includes 78 of the 100 largest firms listed on the Oslo Stock Exchange in 2009, as measured by market capitalization. Data was collected on these firms for the period of 2008 back to 1998 or as far back as the company's first listing on the Oslo Stock Exchange. This sampling method leads to a skewed sample with more observations stemming from recent years than from earlier years. The average firm in the sample had in 2008 been listed on the exchange for a period of 7.2 years. There are a total of 558 CEO-year observations available, but due to missing data on some points, only 425 observations are included in the regressions. The sample includes 140 different individuals, which implies firms had an average of 1.8 different CEOs during the sample period. This ignores the fact that some individuals were CEO for more than one company during the sampling period. Average CEO tenure (including time served before the sample period) is 6.5 years; the median is five.

4.2.1 Data collection

Data on CEO age, tenure, stockholdings, and option and bonus schemes was obtained from annual reports. Data on taxable income and wealth was obtained from the Norwegian tax authorities. Information was requested for specific individuals identified by their name and date of birth, for all years in which they were identified as CEO in annual statements. Included in the data received from the tax offices was information about registered residence, taxable income, taxable wealth and total taxes paid during

the year. All CEO-year observations where the individual was registered abroad for tax purposes were excluded from the sample. In many cases tax data is missing for foreign nationals and Norwegians with primary residence abroad.

Data for the company-level control variables was collected from financial databases. This includes information about the market value of equity, sales revenue, leverage ratio, stock price volatility, current ratio, MTB ratio, profit ratio and earnings per share. Datastream and WRDS were used as primary information sources for variables related to equity, earnings and volatility. The databases Compustat and Amadeus were used to collect further information about financial ratios and in several occasions data was supplemented or completed with the help of the Norwegian online databases Ravninfo.no, Proff.no and Finn.no or firm's annual reports. Firms were classified according to Standard Industrial Classification (SIC) codes (Securities and Exchange Commission, 2009) with the help of indicators from the Oslo stock exchange (Oslobors.no).

4.3 Description of Variables

This section describes briefly how each variable is computed or defined. Additionally, descriptive statistics of the data are presented.

4.3.1 Variable Definitions

Percentage Ownership
Percentage Ownership is the number of shares held by the CEO, plus the number of options held times the delta (0.6), divided by the total amount of shares outstanding at year-end. The resulting figure is then multiplied by 100.

Log Value at Risk
Log Value at Risk is the number of shares held, plus the number of options held times the delta (0.6), multiplied by the share price at year-end. This amount is then transformed by taking its natural logarithm.

Log Non-firm Wealth
In order to clearly separate the dependent from the independent variable, and avoid a possible endogeneity bias, a level of "non-firm" wealth is computed by deducting the value of the CEO's inside equity holdings from the reported taxable wealth figure. Listed

equity holdings are valued at 100% of year-end market value for tax calculations, meaning the computed 'Non-firm Wealth' should accurately represent the tax value of all of the CEO's wealth outside of the firm. Without this adjustment to the wealth figure, the independent variable of CEO wealth would be partially driven by the CEO equity holdings in the dependent variable, creating an endogeneity problem.

The measures of equity incentives in all of the above variables include besides shares and options, also all artificial options and other incentive schemes that directly tie CEO compensation to the stock price. Bonus plans and subjective performance incentives not tied directly to the stock price are not included.

Zero-wealth Dummy
A dummy variable is included to account for instances where taxable non-firm wealth is zero. The Zero-wealth Dummy is set to 1 whenever non-firm wealth is zero and is set to 0 otherwise.

Log Income
Log Income is the natural logarithm of total reported taxable income in Norwegian kroner (NOK) for a CEO in a particular year. It is defined as zero where reported income is zero.

Age
The age variable is defined in years and is calculated by deducting the year of birth of the individual from the year of the observation. For example, in 2005, a person born in 1950 will have an Age of 55.

Tenure
Tenure measures the amount of years the CEO has been in his current position. The variable starts at one, meaning it is defined as 1 in the year the CEO started his current position, 2 the year thereafter etcetera. A squared term of Tenure is included to control for quadratic effects, as well as an interaction term of Age and Tenure.

Log Market Value Equity
The total market value of all outstanding shares at year-end is divided by 1000. The natural logarithm of this figure is taken to arrive at the variable Log Market Value Equity.

Log Sales Revenue

Log Sales Revenue is the natural logarithm of the annual sales revenue, where sales revenue is reported in NOK 1000s.

Book Leverage Ratio

This variable is assumed to proxy for the agency costs of debt in the firm. It is computed by dividing the book value of all liabilities by the book value of all assets, and reported as a fraction of one (percentage divided by 100).

Stock Volatility

Stock Volatility is the standard deviation of the continuously compounded daily stock returns – using adjusted closing prices – rescaled to a yearly figure assuming 261 trading days per year. The variable is reported as a percentage.

Current Ratio

The Current Ratio is defined as current assets divided by current liabilities. It is reported as a fraction of one.

Market-to-Book Ratio

The Market-to-Book ratio, as reported by Datastream, is defined as the market value of all ordinary equity divided by the balance sheet value of all ordinary equity. This variable is also reported as a fraction of one.

Profit Ratio

The Profit Ratio is the ratio of net income to total sales revenue. This is then multiplied by 100 making it a percentage figure.

Earnings per Share

Earnings per Share (EPS) divides net income by the average number of common shares outstanding during the year. The variable is reported as a fraction of one. It should be noted that both Profit Ratio and EPS are included in the analysis as standard control variables. There is no specific theoretical foundation to support their inclusion or predict what sign to expect for their regression coefficients.

Bonus Scheme Dummy

This dummy variable is set to 1 when annual statements indicate the existence a bonus scheme for the CEO that is at the discretion of the board of directors. This concerns

bonuses that are not explicitly and directly tied to the value of equity. The dummy is set to 0 when no such scheme is mentioned.

4.3.2 Descriptive Statistics

Table I below offers descriptive statistics of the complete dataset including all 558 observations. Panel A shows that the average CEO is fifty years of age and has a tenure of 6.5 years. The size of the average firm, as measured by either market value or sales revenue, is much greater than the size of the median firm, and the standard deviation is large. The leverage ratio of firms is remarkably homogeneous, with an average of 0.62 and a standard deviation of 0.19. Much larger differences between observations occur in the variables Profit Ratio and Earnings per Share. The median firm has a profit ratio of just over 5% and an EPS ratio of 2.4. Standard deviations at both these variables are very large indicating great differences between firms and years.

Panel B shows year-by-year information on reported taxable income. Median income increased nearly twofold during the sample period, from 2.15 million NOK in 1998 to 4.25 million NOK in 2008. Income was lowest in 2001 and 2002, the years after the bursting of the Dot-com bubble. Income levels for 2008 do not appear to be affected by the 2008-2009 financial crises, probably because these levels were agreed just before the crisis.

In Panel C non-firm taxable wealth is reported. The most striking observation is that in virtually all years the median, and in some years (2001, 2003, 2004) even the 75th percentile observation features a non-firm wealth level of zero. Furthermore, the 2001-2002 dip that was observed in taxable income can also be seen here.

Panels D and E show information on the dependent variables. The median percentage ownership is approximately constant over the sample period, at around 0.2%. This means that for every 1000 NOK change in shareholder wealth, CEO wealth changes by 2 NOK in the same direction. This level of wealth elasticity is comparable to findings by Jensen and Murphy (1990). Their estimate for wealth elasticity caused by inside stock ownership is $2.50/$1000 or 0.25% at the median.

TABLE I

DATA SAMPLE DESCRIPTION

This table contains summary statistics for the complete 1998-2008 data sample of 558 observations. The sample includes 78 of the 100 largest firms listed on the Oslo Stock Exchange in 2009 as measured by market capitalization. Panel A describes the mean and median cases for CEOs and firms in the sample. Panel B and C give an indication of the distribution of income and taxable wealth, while Panel D and E show the distribution of the two dependent variables. Panels B through E also show the number of observations per year. Panel F shows correlations between variables, with *,** and *** denoting estimates at the 10%, 5% and 1% level of significance respectively. *Age* is the year of the observation minus the year of birth of the CEO. *Tenure* measures how many years the CEO has been in his current position. The variable starts at a value of one, meaning it is defined as 1 in the year the CEO started his position. *Market Value Equity* and *Sales Revenue* are reported in million NOK. *Book Leverage Ratio* is the book value of all liabilities divided by the book value of all assets. *Stock Volatility* (%) is the standard deviation of the daily continuously compounded stock returns, using adjusted closing prices, rescaled to a yearly figure assuming 261 trading days per year. *Current Ratio* is current assets divided by current liabilities. *Market-to-Book Ratio* is the market value of the all ordinary equity divided by the balance sheet value of all ordinary equity. *Profit Ratio* (%) is the ratio of net income to total sales revenue. *Earnings per Share* divides net income by the average number of common shares outstanding during the year. *Income per year* equals total reported taxable income of the CEO. *Non-Firm Wealth per year* is total reported taxable wealth of the CEO, minus the year-end market value all of the CEO's holdings of shares and options in his own company. It is shown in million NOK. *Percentage Ownership* (%) is the number of shares held by the CEO, plus the number of options held times the delta (0.6), divided by the total amount of shares outstanding at year-end. *Value at Risk per year* is the number of shares held, plus the number of options held times the delta (0.6), multiplied by the share price at year-end; in million NOK.

PANEL A. Pooled data for all years

	Mean	Median	Standard deviation
Age	50	50	7.52
Tenure	6.48	5	5.81
Market Value Equity (in million NOK)	14,801	2,830	44,308
Sales Revenue (in million NOK)	15,738	2,266	49,681
Book Leverage Ratio	0.617	0.597	0.186
Stock Volatility (%)	46.77	39.71	24.21
Current Ratio	2.07	1.46	1.94
Market-to-Book Ratio	2.52	1.82	2.41
Profit Ratio (%)	-5.37	5.03	215.71
Earnings per Share	6.56	2.36	19.19

PANEL B. Income per year (million NOK)

	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
Min	0.19	0.21	0.07	0	0	0	0	0.05	0	0	0
25th percentile	1.30	1.34	1.32	1.25	1.32	1.59	2.28	2.56	2.46	2.82	2.22
Median	2.15	2.56	1.94	2.05	2.51	2.41	3.81	4.94	4.40	4.13	4.25
Mean	4.08	5.22	6.72	3.78	2.94	3.81	7.98	12.73	7.17	7.20	8.43
75th percentile	3.42	4.24	3.76	3.16	4.14	3.87	6.70	8.99	8.88	8.40	8.32
Max	32.0	35.0	123.1	58.7	12.39	39.2	59.6	145.5	36.3	53.1	99.8
Number of observations	27	32	36	41	44	39	44	50	60	66	71

PANEL C. Non-Firm Wealth per year (million NOK)

	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
Min	0	0	0	0	0	0	0	0	0	0	0
25th percentile	0	0	0	0	0	0	0	0	0	0	0
Median	0	0	0	0	0	0	0	0	0	0	0.04
Mean	8.11	2.11	2.38	3.11	3.63	3.08	4.72	4.49	8.24	22.06	15.68
75th percentile	3.16	0.37	0.07	0	1.01	0	0	5.44	1.15	6.58	8.90
Max	78.8	39.47	62.1	97.0	66.4	95.7	97.3	40.2	234.0	922.9	302.2
Number of observations	27	32	36	41	44	41	45	51	61	67	72

PANEL D. Percentage Ownership per year											
	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
Min	0	0	0	0	0	0	0	0	0	0	0
25th percentile	0.01	0.03	0.03	0.04	0.04	0.02	0.02	0.03	0.05	0.03	0.03
Median	0.19	0.22	0.16	0.23	0.25	0.18	0.19	0.21	0.21	0.20	0.23
Mean	7.99	8.77	6.52	5.26	5.32	3.80	3.58	3.45	3.76	4.47	3.33
75th percentile	3.40	3.72	0.79	0.99	2.21	1.20	0.96	1.43	1.82	1.69	1.23
Max	51.7	55.5	59.1	59.7	58.2	47.5	47.5	47.5	50.3	50.3	50.5
Number of observations	23	29	32	39	42	42	50	56	66	73	77
PANEL E. Value at Risk per year (million NOK)											
	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
Min	0	0	0	0	0	0	0	0	0	0	0
25th percentile	0.27	1.37	1.70	1.47	1.18	1.59	2.05	2.84	4.64	3.06	1.29
Median	4.48	4.38	4.06	3.70	3.86	5.53	6.95	9.96	13.31	13.78	3.7
Mean	57.51	135.14	142.15	67.73	44.82	38.68	51.31	105.26	153.23	174.36	71.81
75th percentile	47.9	86.92	43.83	14.62	9.98	14.62	18.13	33.11	45.36	83.27	17.29
Max	445.0	1119.5	1559.8	739.6	1137.9	872.7	1318.7	3136.8	5496.4	5024.7	2988.9
Number of observations	23	29	32	39	42	42	50	56	66	73	77

PANEL F. Correlations between variables

	Percentage Ownership	Log Value at Risk	Log Income	Log Non-firm Wealth	Age	Tenure	Log Market Value Equity	Log Sales Revenue	Book Leverage Ratio	Stock Volatility	Current Ratio	Market-to-Book Ratio	Profit Ratio
Log Value at Risk	0.38***												
Log Income	0.09*	0.05											
Log Non-firm Wealth	-0.18***	-0.25***	0.14***										
Age	0.11**	0.04	0.10**	0.00									
Tenure	0.39***	0.24***	0.00	-0.12***	0.33***								
Log Market Value Equity	-0.25***	0.04	0.26***	0.02	0.19***	-0.16***							
Log Sales Revenue	-0.15***	0.01	0.15***	0.06	0.18***	-0.05	0.70***						
Book Leverage Ratio	-0.11***	-0.12***	0.01	0.14***	0.12***	0.02	0.11**	0.42***					
Stock Volatility	0.02	-0.05	-0.18***	-0.02	-0.16***	-0.06	-0.40***	-0.14***	0.02				
Current Ratio	0.04	0.11**	0.00	-0.08*	-0.07*	0.09**	-0.14***	-0.37***	-0.44***	-0.02			
Market-to-Book Ratio	-0.10**	0.10**	0.06	-0.12***	-0.03	-0.05	0.11***	-0.18***	-0.11***	-0.05	0.05		
Profit Ratio	0.03	-0.03	0.03	0.04	-0.04	0.03	0.05	0.20***	0.12***	-0.06	-0.21***	-0.09**	
Earnings per Share	0.02	-0.09**	0.12**	0.06	0.07*	0.05	0.25***	0.14***	-0.06	-0.26***	0.06	-0.05	0.13***

The mean percentage ownership in the sample decreases over time from 8% in 1998 to 3.3% in 2008. Value at Risk, which measures the total value of the CEO's inside holdings of stock and options, is reported in million NOK. This variable shows a strong increasing trend, and is strongly dependent on stock price movements. A clear drop can be seen in both 2001/2002 and 2008. Panels B-E show that more observations come from recent years: there are 3 times more observations from 2008 than from 1998.

Panel F of Table I displays correlations between the variables. Percentage Ownership has a strong positive correlation with the other dependent variable (0.38) as well as positive correlation with the independent variable Tenure (0.39). Not surprisingly, positive correlation coefficients exist between Age and Tenure (0.33); and between Log Market Value Equity and Log Sales Revenue (0.70). Log Market Value Equity and Stock Volatility are strongly negatively correlated (-0.40). Smaller firms are known to have on average more risky equity than larger firms. The size of the firm as measured by sales revenue is also strongly correlated with the leverage ratio (0.42) and the current ratio (-0.37). This indicates that larger firms in the sample are more levered and have lower liquidity than smaller firms. The correlation between Book Leverage Ratio and the Current Ratio is -0.44. All other correlation coefficients are between -0.3 and 0.3.

4.4 Methodology

The aim of the analysis in this thesis is to perform regressions of incentive strength on risk aversion – as proxied by non-firm wealth – while controlling for other influences that affect incentive levels. The methodology in this research is based on Becker (2006) who performs a similar analysis using wealth data from Swedish tax authorities.

4.4.1 Firm Fixed Effects

When analyzing the incentive levels of CEOs from dissimilar firms, the comparison is complicated by the fact that different firms have different policies regarding CEO inside ownership and stock option awards. Depending on specific conditions, histories and company policies, two firms may have different approaches to optimal CEO incentives. A straightforward way to control for these differences between firms would be to include firm

fixed effects in the regression specifications. Fixed effects models are often used in the corporate finance literature as they effectively rule out the possibility of unobserved variable bias. Only the variation *within* firms is examined and incentive level differences *between* firms ignored. The strength of a fixed effects model, however, is also its principal weakness as such a model would discard a large part of the variation in the sample. Using firm fixed effects would remove all inter-firm variation leaving only the variation between years and between CEOs in the same firm. As CEOs often stay on for several years, the analysis would be based mostly on time-series variation where the incentive levels of one individual are compared to the average value over time for this individual. As Becker (2006) notes, the inclusion of firm fixed effects and the subsequent discarding of much of the cross-sectional variation would significantly reduce the power of the model.

In order to still control for the differences between firms and to make sure no omitted variable bias enters, Becker (2006) includes firm control variables that account for firm size and stock volatility; and in an alternative specification also a dummy variable that measure corporate governance strength.

4.4.2 Industry Fixed Effects

The choice of a suitable model for this thesis has to take into account two important methodological issues. Firstly, a balance has to be struck between the aim to utilize as much cross-sectional variation as possible, and the need to control for the inherent differences between firms caused by different industry practices and conditions. The second empirical matter that needs to be addressed is that many variables, especially those relating to accounting data, do not fulfill the criterion of being *independent and identically distributed*. Heteroskedasticity occurs as values are influenced by previous years' values and volatility is not constant over time.

Taking both these issues into consideration, the approach adopted is a Least Squares Dummy Variable model using industry fixed effects. While firm fixed effects would remove too much variation, a more broadly defined set of clusters can retain much of the cross-sectional variation. The method implies grouping the firms in the sample into 22 industry clusters based on two-digit SIC code specifications. Broadly speaking, firms grouped in the

same cluster operate in the same industry and face a similar level of government regulation. There are indications that the level of regulation influences incentives, as David Yermack (1995) finds that companies operating in highly regulated industries use significantly fewer stock option grants for executive compensation (see section 3.3).

The model used means that in practice regressions were run in Stata with the *vce(cluster)* specification to account for the industry fixed effects. This Stata specification allows for correlation within the defined clusters. It requires observations to be independent across clusters, but relaxes this requirement within the clusters. A list of all firms in the sample as grouped by industry is included in Appendix I. There is an average of 3.5 firms per industry cluster. Some clusters, like those related to energy and shipping, are much larger as the Norwegian economy specializes in these sectors.

4.4.3 Control Variables

Dummy variables for every year in the sample are included to account for time specific trends or changes in conditions that affect the entire sample. In addition to these year dummies, several other control variables are added to the model. While industry fixed effects control for the differences between industries, firm control variables are still necessary to control for specific firm characteristics like size or leverage. In addition to the controls for size, volatility, age and tenure that Becker (2006) specifies, I also include information on firms' profitability, liquidity, agency cost of debt, growth opportunities, and executive bonus schemes.

5. RESULTS

5.1 Risk Aversion

Two separate regressions are run, the first one using as dependent variable Percentage Ownership and the second using Value at Risk. The results are shown in Table II below. The number of observations is 425 in both regressions, while R-squared is slightly higher in the Percentage Ownership (0.35) than in the Value at Risk regression (0.23). Regression coefficients for the risk aversion proxies of Log Non-firm Wealth and Log Income are also larger and have stronger statistical significance in the Percentage Ownership regression.

As mentioned earlier, the prediction based on agency theory is that the variables that proxy for risk aversion, Log Income and Log Non-firm Wealth, will have positive signs in both specifications. If we take a look at the first regression – with Percentage Ownership as dependent variable – positive regression coefficients can be seen for Log Income (0.695) and Log Non-firm Wealth (1.302). These values are statistically significant at the 1% and 5% level respectively. The coefficients of these logged independent variables imply that ceteris paribus a one percent increase in a CEO's non-firm wealth increases his value of Percentage Ownership by 1.302 percentage points. A CEO with one percent more reported taxable income than an otherwise identical CEO will have a percentage ownership that is 0.695 percentage points higher. The Zero-wealth Dummy variable registers cases where the CEO has zero non-firm taxable wealth. This identifies CEOs who have all their wealth tied up in the firm, but it can also be interpreted as registering those individuals that are very skilled at evading taxes. The highly economically and statistically significant regression coefficient of 24.577 is consistent with the latter interpretation.

In the second regression, the coefficients have to be interpreted in a slightly different way than in the first, because the dependent variable is in logged values. The coefficient for Log Income is 0.123 implying that a one percent increase in taxable income leads to a 0.123% increase in the total value of the CEO's inside equity holdings. However, this coefficient is only significant at the 10% level. The coefficients for Log Non-firm Wealth and the zero-wealth dummy have positive signs but these results are not statistically significant.

TABLE II

REGRESSIONS OF INCENTIVE STRENGTH ON LOG NON-FIRM WEALTH

The results of two separate regressions of incentive strength on Log Non-firm Wealth are shown in this table, the first with dependent variable Percentage Ownership and the second with Log Value at Risk. *Percentage Ownership* (%) is the number of shares held by the CEO, plus the number of options held times the delta (0.6), divided by the total amount of shares outstanding at year-end. *Value at Risk* is the number of shares held, plus the number of options held times the delta (0.6), multiplied by the share price at year-end; in million NOK. *Income* equals total reported taxable income in NOK of the CEO. *Non-Firm Wealth* is total reported taxable wealth of the CEO; minus the year-end market value all of the CEO's holdings of shares and options in his own company. *Age* is the year of the observation minus the year of birth of the CEO. *Tenure* measures how many years the CEO has been in his current position. The variable starts at a value of one, meaning it is defined as 1 in the year the CEO started his position. *Market Value Equity* and *Sales Revenue* are in NOK 000's. *Book Leverage Ratio* is the book value of all liabilities divided by the book value of all assets. *Stock Volatility* (%) is the standard deviation of the daily continuously compounded stock returns, using adjusted closing prices, rescaled to a yearly figure assuming 261 trading days per year. *Current Ratio* is current assets divided by current liabilities. *Market-to-Book Ratio* is the market value of the all ordinary equity divided by the balance sheet value of all ordinary equity. *Profit Ratio* (%) is the ratio of net income to total sales revenue. *Earnings per Share* divides net income by the average number of common shares outstanding during the year. Standard errors are adjusted for clustering by industry, where clusters are defined at the 2-digit SIC industry code level. Heteroskedasticity robust standard errors are reported in parentheses. *,** and *** denote estimates at the 10%, 5% and 1% level of significance respectively.

Variable	Percentage Ownership	Log Value at Risk
Log Income	0.695***	0.123*
	(0.236)	(0.064)
Log Non-firm Wealth	1.302**	0.536
	(0.582)	(0.370)
Zero-wealth Dummy	24.577**	10.424
	(8.933)	(6.118)
Age	0.339	0.089
	(0.274)	(0.088)
Tenure	1.659	0.757**
	(1.071)	(0.355)
Tenure x Tenure	0.060**	0.010
	(0.023)	(0.010)
Tenure x Age	-0.045	-0.014
	(0.027)	(0.010)
Bonus Scheme Dummy	-3.734***	0.181
	(0.942)	(0.906)
Log Market Value Equity	-2.247*	-0.254
	(1.110)	(0.364)
Log Sales Revenue	-0.014	0.471
	(0.723)	(0.385)
Book Leverage Ratio	-8.800	-4.565
	(6.302)	(3.454)
Stock Volatility	-0.016	-0.005
	(0.021)	(0.017)
Current Ratio	-0.311	0.070
	(0.714)	(0.219)
Market-to-Book Ratio	-0.332	0.184
	(0.291)	(0.206)
Profit Ratio	0.002	-0.001
	(0.002)	(0.000)
Earnings per Share	0.063	-0.034
	(0.054)	(0.034)
R^2	0.35	0.23
Number of Observations	425	425

5.2 Other Effects

The regressions include two CEO-level control variables, Age and Tenure, as well as a squared term for Tenure and an interaction term of Age*Tenure. The Age coefficient has positive signs in both regressions but is not statistically distinguishable from zero. CEO tenure does appear to affect incentive levels. There is a linear effect in the Percentage Ownership regression with a positive coefficient of 0.757 and a quadratic effect in the second regression, where the coefficient is 0.060. Both are significant at the 5% level. This is counter to the predictions of standard agency theory (eg. Eisenhardt, 1989) but consistent with the findings of several empirical papers (eg. Gerhart & Milkovich, 1990; Core & Guay, 1999; Becker, 2006). A possible explanation is that providing equity incentives becomes less costly and thus more attractive as tenure increases. The reasoning is that after a longer period in office, uncertainty about the CEOs abilities is reduced and effort levels can be measured more accurately. The CEO becomes less exposed to risk factors beyond his control, and subsequently demands a lower risk premium for risky pay.

The dummy variable that indicates the existence of other executive bonus schemes has a highly significant negative coefficient (-3.734) in the first regression, but switches signs and becomes insignificant in the Value at Risk regression. The intuition behind this dummy is that if firms provide incentives using discretionary bonus systems, this will substitute for stock and option incentives.

The size effect of firms is controlled for using data on sales revenues and the market value of equity. There is strong correlation between these variables, but both are included as this increases the predictive power of the model. The coefficient for Log Market Value Equity is -2.247 in the first regression, which is in line with research that supports the agency theoretic tradeoff of risk versus incentives and the intuition of personal wealth constraints (Jensen & Murphy, 1990; Bizjak et al., 1993; Garen, 1994; Schaefer, 1998).

It should be noted that the main goal at this point is not to draw conclusions about the influences of all variables, but rather to control for variables other than the risk aversion proxies as best as possible. Many control variables have statistically insignificant coefficients, and most variables behave roughly as expected. The possible exception is the

Market-to-Book Ratio in the first regression, which has a negative (though statistically insignificant) sign.

Excluding the firm-level control variables from the regressions would increase the number of observations for both regressions from 425 to 465; but R-squared would be significantly lower: 0.28 for the Percentage Ownership specification and 0.18 for the Value at Risk regression. More importantly, without the firm-level controls the coefficients for Log Non-firm Wealth and Log Income become insignificant in the first regression and the same happens for Tenure in the Value at Risk regression. This emphasizes the importance of controlling for firm effects even in a model with industry fixed effects.

6. SUMMARY AND CONCLUSIONS

A review of the extant literature on agency theory reveals the conflicting goals of managers and shareholders of public corporations, and the agency costs that result from this. Equity incentives are provided to the CEO in order to align goals and maximize firm value. However, there are limits to the provision of incentives, and a theoretically optimal level is assumed to exist, which depends on various factors. Agency theory predicts that a trade-off between goal alignment and the cost of providing risky remuneration will determine optimal executive incentive levels.

Initially, empirical research concluded that incentive levels as measured by the percentage of CEO inside ownership are too low to be consistent with agency theory (Jensen and Murphy, 1990). This view has since been countered by scholars who stress the importance of agency costs of debt, wealth constraints, and risk aversion.

In an effort to empirically prove the influence of risk aversion on incentives, this thesis performs regressions of incentives on two variables that are assumed to proxy for risk aversion: taxable income and taxable wealth. Previous research of this nature by Moers and Peek (2004) and Becker (2006) has found evidence – consistent with agency theory – of a negative effect of risk aversion on incentive levels.

The sample in this thesis includes large firms listed on the Oslo Stock Exchange, for a 10-year sample period. Incentives are measured as both the percentage of shares and options held by the CEO, as well as the total monetary value of these holdings. A Least Squares Dummy Variable model is used, with industry fixed effects to control for differences between industries. Additional CEO-level and firm-level control variables are included in the regression specifications. Separate regressions are run for the Percentage Ownership and the Value at Risk variable.

The results indicate that, consistent with agency theory, CEO wealth has a positive effect on the strength of incentives. Wealthier CEOs have lower absolute risk aversion and therefore require a lower risk premium when confronted with risky pay. This raises the optimal level of incentives provided by the firm. However, the evidence is only statistically significant in

the regression of Percentage Ownership and not in the Value at Risk regression. Using Percentage Ownership as dependent variable implies measuring incentives based on value sensitivity (δCEOWealth/δMarketValue) while Value at Risk assumes return sensitivity. Becker (2006) finds positive evidence for a wealth effect regardless of the assumption of value or return sensitivity.

Over the sample period of 1998-2008, total Value at Risk increased while Percentage Ownership decreased (see table I). While the value of inside equity holdings increased, the goal alignment between CEOs and shareholders as measured by the sharing rate decreased.

From a goal alignment perspective – the perspective of the principal – it can be argued that Percentage Ownership is a more suitable measure of incentives, because it essentially shows the degree to which the agent is also a principal. The Percentage Ownership regression proves that the wealth level of a CEO is an important determinant of his incentive strength. This is in line with theoretical predictions and confirms the hypothesis that CEO incentives provided by stock and option ownership are higher when CEOs have more wealth.

In contrast to the Percentage Ownership measure, the Value at Risk variable measures the absolute dimension of the incentive strength and thus better represents the agent's point of view. After controlling for the size of the firm there is no conclusive proof of a relationship between a CEOs non-firm wealth and the amount of inside equity held.

6.1 Suggestions for Future Research

The replicability of the analysis performed in this thesis outside Norway or Sweden is limited, as no other countries make a similar level of detail about individual's wealth levels publicly available. However, in order to further improve our understanding of the determinants of incentives, additional empirical research may be necessary. Future research could aim to find a reliable way to measure levels of CEO skill and power, as these variables may have a large influence on incentive levels.

A large issue with the obtained data is the measurement error in the wealth variable due to tax evasion. Future research might involve an attempt to correct for this, for instance with the use of an Errors-in-Variables Model as developed by Erickson and Whited (2002).

A further application of the collected wealth data could be to examine the relationship between CEO risk aversion and (industry-adjusted) indicators of firm risk like stock volatility, beta, or leverage ratio. CEOs with high risk aversion might self-select into safer firms, or influence the firms' investment risk after they are hired. However, the reverse relationship may also hold. To the extent that CEOs can successfully influence firm risk, this may provide information about the CEO's risk aversion. In other words, the firms' leverage ratio could serve as a noisy proxy for CEO risk aversion.

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APPENDICES

APPENDIX I

LIST OF FIRMS IN THE SAMPLE, CLUSTERED BY 2-DIGIT INDUSTRY SIC CODE

SIC code cluster	Companies in cluster
7	Yara International
13	AGR Group, Aker, Aker Solutions, Bonheur, BW Offshore Limited, Deep Sea Supply, Det norske oljeselskap , DNO International, DOF, Eidesvik Offshore, Farstad Shipping, Fred. Olsen Energy, GC Rieber Shipping, I.M. Skaugen, Norse Energy Corp., Norwegian Energy , Petroleum Geo-Ser , Rem Offshore, Sevan Marine, Siem Offshore, Solstad Offshore, Songa Offshore, Statoil, Subsea 7
15	AF Gruppen, BWG Homes, Ekornes, Infratek, Veidekke
20	Austevoll Seafood, Cermaq, Copeinca, Grieg Seafood, Lerøy Seafood Group, Marine Harvest, Orkla, Rieber & Søn, SalMar
26	Norske Skogindustrier
27	Schibsted
28	Algeta, Photocure, Pronova BioPharma
33	Norsk Hydro, Scana Industrier
35	Hexagon Composites, Odim, Prosafe
36	Eltek, Nordic Semiconductor, Q-Free, Renewable Energy , Tandberg
37	Kongsberg Automot , Kongsberg Gruppen
38	Axis-Shield
44	Odfjell, Star Reefers Inc., Wilh. Wilhelmsen
45	Norwegian Air Shuttle, SAS AB
48	Telenor
49	Arendals Fossekompani, Hafslund
60	Dnb NOR
61	Aktiv Kapital, Imarex
62	ABG Sundal Collier
63	Storebrand
65	Norwegian Property, Olav Thon Eiendom, Scandinavian Property
73	Atea, EDB Business Partner, Opera Software, StepStone, Tomra Systems

APPENDIX II

RAW STATA OUTPUT

```
Linear regression                                       Number of obs =     425
                                                        F( 19,    20) =       .
                                                        Prob > F      =       .
                                                        R-squared     =  0.3531
                                                        Root MSE      =  10.474

                                (Std. Err. adjusted for 21 clusters in sic_id)
------------------------------------------------------------------------------
             |               Robust
   ownership |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
      income |   .6948805   .2363492     2.94   0.008     .2018646    1.187896
      wealth |   1.302294   .5821584     2.24   0.037     .0879328    2.516655
  zeroweadum |   24.57684   8.933055     2.75   0.012     5.942813    43.21087
         age |    .338578    .274496     1.23   0.232    -.2340107    .9111667
      tenure |   1.658562    1.07145     1.55   0.137    -.5764438    3.893568
    tenure_2 |   .0601201   .0228032     2.64   0.016     .0125534    .1076868
  otherbonus |  -3.734437   .9424744    -3.96   0.001    -5.700404    -1.76847
   valshares |  -2.247015   1.110438    -2.02   0.057    -4.563347    .0693174
    salesrev |  -.0144753   .7230332    -0.02   0.984    -1.522696    1.493746
   age_x_ten |  -.0447572   .0274934    -1.63   0.119    -.1021073     .012593
bookleverage |  -8.800112   6.301754    -1.40   0.178    -21.94534    4.345117
    stockvol |  -.0162737   .0209816    -0.78   0.447    -.0600405    .0274932
   currratio |  -.3105694   .7144414    -0.43   0.668    -1.800868    1.179729
     mbratio |  -.3315254    .290903    -1.14   0.268    -.9383383    .2752875
 profitratio |   .0024732   .0020175     1.23   0.234    -.0017352    .0066816
         eps |    .063132   .0544711     1.16   0.260    -.0504926    .1767566
       y1999 |   1.297739   3.309234     0.39   0.699    -5.605201     8.20068
       y2000 |   .3609476   2.268038     0.16   0.875    -4.370096    5.091991
       y2001 |   .3671352    2.73343     0.13   0.894    -5.334701    6.068971
       y2002 |  -.7631241   3.094168    -0.25   0.808    -7.217446    5.691198
       y2003 |  -1.949084   2.687734    -0.73   0.477    -7.555598     3.65743
       y2004 |   -2.08351   2.959463    -0.70   0.490    -8.256843    4.089822
       y2005 |  -.4428877   2.550776    -0.17   0.864    -5.763713    4.877937
       y2006 |   .0295084   3.068522     0.01   0.992    -6.371316    6.430333
       y2007 |  -.3017039   2.929135    -0.10   0.919    -6.411772    5.808364
       y2008 |  -2.112199   1.784994    -1.18   0.251    -5.835632    1.611234
       _cons |  -2.721693   15.48442    -0.18   0.862    -35.02162    29.57823
------------------------------------------------------------------------------
```

```
Linear regression                                       Number of obs =     425
                                                        F( 19,    20) =       .
                                                        Prob > F      =       .
                                                        R-squared     =  0.2266
                                                        Root MSE      =  4.5543

                                (Std. Err. adjusted for 21 clusters in sic_id)
------------------------------------------------------------------------------
             |               Robust
 valueatrisk |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
      income |    .123077   .0644051     1.91   0.070    -.0112696    .2574237
      wealth |   .5362761   .3701583     1.45   0.163    -.2358606    1.308413
  zeroweadum |   10.42391   6.118385     1.70   0.104    -2.338818    23.18664
         age |   .0888216   .0877263     1.01   0.323    -.0941723    .2718154
      tenure |   .7565319   .3549587     2.13   0.046     .0161011    1.496963
    tenure_2 |   .0104899   .0095569     1.10   0.285    -.0094455    .0304253
  otherbonus |   .1812225   .9063278     0.20   0.844    -1.709344    2.071789
   valshares |  -.2538703   .3644248    -0.70   0.494    -1.014047    .5063065
    salesrev |   .4706575   .3853846     1.22   0.236    -.3332408    1.274556
   age_x_ten |  -.0142106   .0099783    -1.42   0.170     -.035025    .0066037
bookleverage |   -4.56472   3.454032    -1.32   0.201     -11.7697    2.640264
    stockvol |  -.0050858   .0172829    -0.29   0.772    -.0411373    .0309657
   currratio |   .0704563   .2192529     0.32   0.751    -.3868972    .5278097
     mbratio |   .1840224   .2056531     0.89   0.382    -.2449625    .6130072
 profitratio |    -.00074   .0004933    -1.50   0.149     -.001769    .0002889
         eps |  -.0342122   .0341157    -1.00   0.328    -.1053763    .0369519
       y1999 |   2.502093   1.252242     2.00   0.059    -.1100371    5.114224
       y2000 |    2.17804   1.872922     1.16   0.259    -1.728808    6.084887
       y2001 |   3.158862   1.888983     1.67   0.110     -.781487    7.099211
       y2002 |   3.918024   2.276606     1.72   0.101    -.8308924     8.66694
       y2003 |    2.04036   2.140736     0.95   0.352    -2.425137    6.505856
       y2004 |   3.434565   1.832886     1.87   0.076    -.3887686    7.257899
       y2005 |   4.090753   2.077914     1.97   0.063    -.2437001    8.425205
       y2006 |   4.262511   2.308769     1.85   0.080    -.5534968    9.078519
       y2007 |   4.810009   2.352953     2.04   0.054    -.0981645    9.718183
       y2008 |   3.979365    1.99437     2.00   0.060    -.1808181    8.139548
       _cons |  -6.344181   11.55502    -0.55   0.589    -30.44753    17.75917
------------------------------------------------------------------------------

Linear regression                                       Number of obs =     465
                                                        F( 18,    21) =  384.78
                                                        Prob > F      =  0.0000
                                                        R-squared     =  0.2756
                                                        Root MSE      =  10.552

                                (Std. Err. adjusted for 22 clusters in sic_id)
------------------------------------------------------------------------------
             |               Robust
   ownership |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
      income |   .4440347    .321779     1.38   0.182    -.2251413    1.113211
      wealth |    1.03447   .6035292     1.71   0.101    -.2206374    2.289578
  zeroweadum |   19.86726    9.14137     2.17   0.041     .8567405    38.87778
         age |   .2595298   .2571888     1.01   0.324    -.2753235    .7943831
      tenure |   2.056105   1.108771     1.85   0.078    -.2497101     4.36192
    tenure_2 |   .0672181   .0226806     2.96   0.007     .0200511     .114385
  otherbonus |  -4.358106   .9272694    -4.70   0.000    -6.286468   -2.429744
   age_x_ten |  -.0518983   .0281167    -1.85   0.079    -.1103702    .0065736
       y1999 |   1.208188   2.296959     0.53   0.604      -3.5686    5.984975
       y2000 |   .1419889   1.921967     0.07   0.942     -3.85496    4.138938
       y2001 |  -.2003355   2.453591    -0.08   0.936    -5.302858    4.902187
       y2002 |   .6683733   3.071468     0.22   0.830    -5.719095    7.055842
       y2003 |   -1.60058   2.573542    -0.62   0.541    -6.952554    3.751394
       y2004 |  -1.926663   2.750989    -0.70   0.491    -7.647657    3.794332
       y2005 |  -1.483198   2.526723    -0.59   0.563    -6.737806     3.77141
       y2006 |  -1.313247   2.570098    -0.51   0.615    -6.658058    4.031564
       y2007 |  -1.217537   2.321599    -0.52   0.605    -6.045567    3.610493
       y2008 |  -1.804319    1.96083    -0.92   0.368    -5.882089    2.273451
       _cons |  -32.35439   16.17153    -2.00   0.059    -65.98493    1.276145
------------------------------------------------------------------------------
```

```
Linear regression                                       Number of obs =     465
                                                        F( 18,    21) =   57.12
                                                        Prob > F      =  0.0000
                                                        R-squared     =  0.1800
                                                        Root MSE      =  4.6282

                                 (Std. Err. adjusted for 22 clusters in sic_id)
------------------------------------------------------------------------------
             |               Robust
 valueatrisk |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
      income |   .1427204   .0648241     2.20   0.039     .0079112    .2775295
      wealth |   .5888485   .3931833     1.50   0.149    -.2288208    1.406518
  zeroweadum |   11.90024   6.566016     1.81   0.084    -1.754536    25.55502
         age |   .0394322   .1002878     0.39   0.698    -.1691276    .2479921
      tenure |   .6396084   .4235479     1.51   0.146    -.2412076    1.520424
    tenure_2 |   .0067946   .0107873     0.63   0.536    -.0156387    .0292279
  otherbonus |  -.4574495   .9356265    -0.49   0.630    -2.403191    1.488292
   age_x_ten |  -.0106611   .0117577    -0.91   0.375    -.0351127    .0137905
       y1999 |   2.080304   .8704413     2.39   0.026     .2701218    3.890485
       y2000 |   1.675386   1.416257     1.18   0.250    -1.269882    4.620654
       y2001 |   2.330406   1.523746     1.53   0.141    -.8383981     5.49921
       y2002 |   2.792841   1.833612     1.52   0.143    -1.020364    6.606045
       y2003 |   .9145422   1.767666     0.52   0.610    -2.761521    4.590606
       y2004 |   2.245879   1.445563     1.55   0.135    -.7603345    5.252092
       y2005 |   2.866219   1.653256     1.73   0.098    -.5719157    6.304354
       y2006 |   2.970182   1.878122     1.58   0.129     -.935586     6.87595
       y2007 |   3.440723   1.926717     1.79   0.089    -.5661045     7.44755
       y2008 |   2.742489   1.726182     1.59   0.127    -.8473033    6.332281
       _cons |  -3.797719   10.73598    -0.35   0.727    -26.12441    18.52897
------------------------------------------------------------------------------
```