**London Business School**

# *Executive Compensation and Corporate Governance*

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## Declaration

I certify that the thesis I have presented for examination for the PhD degree of the London Business School is solely my own work other than where I have clearly indicated that it is the work of others (in which case the extent of any work carried out jointly by me and any other person is clearly identified in it).



I warrant that this authorization does not, to the best of my belief, infringe the rights of any third party.

## Abstract

This thesis contains five chapters. The first chapter provides an introduction and the fifth chapter a brief conclusion. In the second chapter, I study the relationship between CEO optimism and optimal compensation contracts both theoretically in a two period principal-agent model and empirically in a sample of US firms. The model predicts that optimists receive lower incentive and total pay than unbiased agents. Using data on compensation in US firms, I provide evidence that CEOs whose option exercise behavior and earnings forecasts are indicative of optimistic beliefs indeed receive smaller stock option grants, fewer bonus payments, and less total compensation than their peers.

The third chapter documents an unintended effect of the Sarbanes-Oxley Act (SOX). The objective behind SOX was to improve corporate governance by improving accounting disclosures. Compliance with Section 404 is considered by many to be the most costly requirement of SOX and has been argued to be a disproportionate burden for small firms. Consequently, firms with a public float below $75 million were granted several exemptions from compliance. These exemptions entailed a weakening of corporate governance through a weakening of the market for corporate control.

In the fourth chapter, I examine the role of private benefits in optimal compensation and monitoring arrangements in a simple principal-agent framework. If the cost of monitoring is not too high, the optimal incentive scheme, level of monitoring, and the agent's expected total monetary compensation are not monotone in the level of potentially available private benefits. It can be optimal to allow the extraction of benefits—even if they are not productivity enhancing and if their direct costs exceed their direct value.

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# Chapter 1

# Introduction

This thesis contains research on executive compensation and corporate governance in three chapters. In the second chapter, entitled "CEO Optimism and Incentive Compensation", I study the relationship between CEO optimism and optimal compensation contracts both theoretically in a two period principal-agent model and empirically in a sample of US firms. In the model, agents with optimistic beliefs overestimate the value of compensation claims that are contingent on positive outcomes. Optimists are also more prone to retain incentive claims because they believe the market price for those claims to be too low. The model predicts that optimists receive lower incentive and total pay than unbiased agents. Using data on compensation in US firms, I provide evidence that CEOs whose option exercise behavior and earnings forecasts are indicative of optimistic beliefs indeed receive smaller stock option grants, fewer bonus payments, and less total compensation than their peers. I do not find any evidence that these results can be explained by differences in firm performance or corporate governance, inside information or procrastination, or differences in the risk-tolerance of the CEOs. The results show how sophisticated principals can take advantage of optimistic agents by optimally adjusting their compensation contracts and shed some light on the potential benefits of hiring such agents. Furthermore, the findings add to our understanding of the interplay between managerial beliefs and compensation and may ultimately help to reconcile some of the unexplained heterogeneity in the remuneration of observationally similar individuals.

The third chapter—"The Unintended Effects of the Sarbanes-Oxley Act"—documents an unintended effect of the Sarbanes-Oxley Act (SOX) on the market for corporate control.[1] SOX was introduced after a series of corporate scandals and has been commonly

[1] "The Unintended Effects of the Sarbanes-Oxley Act" is joint work with Vidhi Chhaochharia (University of Miami) and Vikrant Vig (London Business School) and has been published in the Journal of

considered the single most important piece of securities legislation pertaining to corporate governance and financial disclosure since the Securities Acts of the 1930s. The act was intended to restore investor confidence by placing new rules and restrictions on several corporate entities in order to improve the accuracy and reliability of corporate disclosures. Broadly speaking, SOX was aimed at improving corporate governance for public US companies. In this chapter, however, we provide evidence that exempting firms with a public float of less than $75 million from compliance with Section 404 has lowered the takeover activity involving such firms and led to a reduction in the takeover premiums that were paid in the acquisitions. These results suggest that SOX, which was drafted as a reform to strengthen governance, may in fact have weakened corporate governance for small US firms by adversely affecting the market for corporate control.

In the fourth chapter, entitled "Paying with Private Benefits", I examine the role of private benefits in optimal compensation and monitoring arrangements in a simple principal-agent framework. Three main observations emerge from this analysis. First, the optimal level of monitoring, incentive pay, and the agent's expected total compensation are not monotone in the level of potentially available private benefits. For low levels and high levels of potential private benefits, it can be optimal not to monitor at all and to either resort entirely to incentive pay to induce the desired actions, or to allow the extraction of private benefits and internalize their value through a reduction in the agent's salary. Second, the principal's ability to monitor, i.e., to prevent the agent from enjoying the private benefits, increases overall efficiency. It can help to ameliorate the agency conflict and induce more efficient project selection. Third, the optimal mix of monitoring and incentive pay depends crucially on the agent's valuation of the potentially extractable private benefits. This has implications for empirical research because the potentially available benefits might never be realized and are therefore difficult to observe. Furthermore, the valuation of the benefits might be highly subjective—after all, they are *private* benefits. Thus, considering agent specific factors may be crucial in an attempt to explain observed incentive and monitoring arrangements.

The fifth chapter concludes the thesis.

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# Chapter 2

# CEO Optimism and Incentive Compensation

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## 2.1 Introduction

How should one compensate a manager who holds biased beliefs about the world? Bertrand and Schoar (2003) and Graham, Li, and Qiu (2012) show that a significant fraction of the variation in corporate practices and executive compensation can be explained by manager fixed effects. The authors interpret these findings as evidence that managerial "style" and latent individual characteristics affect corporate policies, actions, and outcomes. Two such latent characteristics that have received much attention in the recent past are managerial overconfidence and optimism, and a rapidly growing literature has provided ample evidence for their impact on corporate behavior.[1] Ben-David, Graham, and Harvey (2010), for example, find that financial executives are both overconfident and optimistic and that firm investment is increasing in both biases. Landier and Thesmar (2009) show how entrepreneurial optimism affects the choice of debt maturity, and Malmendier and Tate (2005a, 2005b, 2008) and Malmendier, Tate, and Yan (2011) provide evidence that overconfident CEOs display higher investment-cash flow sensitivities, are more acquisitive, and are less likely to rely on equity financing than their peers. Given these findings, a natural question to ask is whether and how such biases in beliefs are reflected in compensation arrangements and incentive schemes.

In this paper, I study the relationship between CEO optimism and optimal compensation contracts both theoretically in a two period model and empirically in a sample of US firms. I focus on CEOs because their compensation contracts are more likely to be tailored to their individual characteristics than the compensation plans offered to rank-and-file employees. CEO compensation contracts thus provide a laboratory in which the effect of optimism on contract design can be examined.[2]

In the context of my model, I highlight two channels through which an agent's optimism affects the optimal compensation scheme. First, optimistic agents overestimate the value of compensation claims that are contingent on positive outcomes. This allows

[1] Explanations for corporate actions that are based on managerial optimism or overconfidence, of course, go back at least as far as Roll's (1986) hubris hypothesis of corporate takeovers. The distinction between overconfidence and optimism, however, is sometimes blurred in the literature. In this paper, an agent is considered optimistic if he believes that good outcomes are more likely than they really are. An agent is considered overconfident if he believes that information he possesses is more precise than it really is.

[2] Whether and how employee optimism may explain the provision of broad-based option plans to employees below the top-management level is examined, for example, by Oyer and Schaefer (2005) and Bergman and Jenter (2007).

the principal to reduce the optimist's compensation relative to that of an unbiased agent. Second, optimists are more prone to retain previously received incentive claims because they believe the market price that outside investors are willing to pay for these claims to be too low.[3] The net-effect of retaining a larger fraction of a smaller amount of contingent claims thus determines whether the agent accumulates more or fewer incentives over time. In any given period, the total effect of an agent's optimism on the different components of his compensation depends on the relative magnitudes of the overvaluation and accumulation effects. The model implies, however, that the average effect of an agent's optimism on his incentive compensation as well as on his total pay is strictly negative. Thus, sophisticated principals can take advantage of optimistic agents by appropriately adjusting their compensation contracts and paying them less than what an unbiased agent would demand.

Using data on compensation in US firms, I provide empirical evidence that CEOs whose behavior is indicative of optimistic beliefs indeed receive smaller stock option grants, fewer bonus payments, and lower total compensation than their peers. I assess each CEO's optimism with two different measures. The first measure is based on the earnings forecasts that are released by the firms. A forecast that exceeds the ex-post realized earnings or, alternatively, the analyst consensus forecast is classified as "optimistic", and the fraction of optimistic forecasts is used as a proxy for the CEO's optimism. The rationale behind this approach is that optimistic CEOs overestimate their firm's future performance and should thus be more likely than their peers to release inflated earnings forecasts. The second measure is based on the CEO's option exercise decisions and follows the rationale proposed by Malmendier and Tate (2005a, 2005b, 2008) and Malmendier, Tate, and Yan (2011). Exercises during the final year before the options' expiration date—despite the fact that the options were already deep in the money at the end of the previous year—are classified as "late" and taken as an indication for optimistic beliefs about the company's prospects. The fraction of late option exercises is then used as a proxy for the CEO's optimism.

The empirical findings are robust to controlling for various CEO and firm level characteristics, as well as firm and year fixed effects, and are confirmed in multiple robustness

[3] This result is akin to the reasoning in Malmendier and Tate (2005a, 2005b, 2008) and Malmendier, Tate, and Yan (2011). Empirical evidence that optimistic mangers indeed overvalue their options is provided, for example, by Sautner, Weber, and Glaser (2010).

tests. Furthermore, I entertain several alternative explanations and show that they are not sufficient to explain the results. In particular, to address the concern that the CEOs are appointed based on each firm's individual target level of optimism, I model the preferred level of optimism for each firm as the sum of two components: a time-invariant, unobservable base level and a time-varying, linear combination of observable firm characteristics. Controlling for this specification, I do not find any evidence that the findings are explained by differences in firm characteristics which may be related to both the decision to hire an optimistic CEO as well as to his compensation. Similarly, controlling for differences in firm performance and board characteristics does not change the results. Neither do I find any evidence that the late exercising of in-the-money options can be explained by differences in the CEOs' portfolios of company stock and options, inside information, or procrastination.

Regarding the optimism measure based on the CEOs' forecasting behavior, robustness tests based on analyst consensus estimates as well as an analysis based on management forecasts that are released after the CEOs were awarded their option packages confirm that the lower compensation of optimists is not merely the result of missing a given earnings target. CEOs whose earnings forecasts systematically exceed the contemporaneous analyst estimates and CEOs who issue exceedingly high forecasts in the years following the option awards both receive lower valued option grants and less total compensation than their peers. Furthermore, controlling for whether or not the realized earnings exceed the last year's earnings or the analyst consensus forecast does not change the results.

Comparing the compensation of CEOs who release forecasts that are always too low with the compensation of CEOs whose forecasts are always too high reveals that the results are not driven by the CEOs' inability to produce accurate earnings estimates. Only the CEOs that habitually overestimate their firms' future earnings, i.e., the overly optimistic CEOs, receive lower incentive and total pay than their unbiased counterparts. Pessimistic CEOs, to the contrary, are found to receive more incentives and higher total compensation than their peers. This suggests that inaccurate forecasts per se are not a sign of lower talent which in turn causes lower compensation. Moreover, controlling for the confidence that the CEOs place in their own forecasts as measured by the widths of the forecast ranges has no material affect on the results.

Finally, I provide empirical evidence for a negative association between the utilized measures of CEO optimism and the fraction of incentives in the CEOs' total compensation. If the systematic late exercising of in-the-money options and the persistent issuing of inflated earnings forecasts were driven by a higher risk-tolerance of the CEOs, then one would expect the opposite result.[4] The negative association between the optimism measures and the percentage of incentives in the CEOs' total compensation thus suggests that the findings are not explained by a higher risk-tolerance of the CEOs.

The paper contributes to the existing literature on managerial biases and CEO compensation in several ways. First, I show how an agent's optimism affects the design of the optimal compensation contract. Second, I provide empirical evidence that CEO optimism is indeed reflected in CEO compensation. CEOs whose option exercise behavior and earnings forecasts are indicative of optimistic beliefs receive smaller stock option grants, fewer bonus payments, and less total compensation than their peers. These results show how sophisticated principals can take advantage of optimistic agents by optimally adjusting their compensation contracts and shed some light on the potential benefits of hiring such agents.[5] Finally, the findings add to our understanding of the interplay between managerial beliefs and compensation and may ultimately help to reconcile some of the unexplained heterogeneity in the remuneration of observationally similar individuals.

Within the existing theoretical literature, the paper is most closely related to the work of Gervais, Heaton, and Odean (2011). In their model, the authors consider an agent who is overconfident and therefore overestimates the precision of a privately available signal regarding the quality of an investment opportunity. If the principal optimally adjusts the agent's pay to this bias, mildly overconfident agents are compensated with less convex contracts than their peers, whereas extremely overconfident agents are compensated with more convex contracts. This paper differs in that I focus on managerial optimism rather than overconfidence. That is, I consider an agent who believes that his projects are intrinsically better than they really are, rather than an agent who overestimates the precision of some signal regarding the project's quality. Moreover, I examine the effects

[4] See, for example, Bellemare and Shearer (2010), Graham, Harvey, and Puri (2010), Grund and Sliwka (2010), and Dohmen and Falk (2011).

[5] This finding is consistent with Heaton (2002, p. 34), who notes that "the interests of principals may be served best by the design of mechanisms that exploit managerial irrationality rather than squash it. For example, principals may design incentive mechanisms that underpay irrational agents by exploiting the agents' incorrect assessments of their ability or the firm's risk."

of managerial optimism in a two period model, in which the agent's bias can produce spill over effects from the first to the second period. Finally, I consider an intermediate stage at which the agent can decide to sell a fraction of his incentive claims to an outside investor. This decision is affected by the agent's optimism and thus creates an additional link between the agent's beliefs and his compensation.

In the empirical literature, Graham, Harvey, and Puri (2010) is the most closely related work. Using data obtained from psychometric tests, the authors show among other findings that CEOs with a higher risk-aversion are less likely to be compensated with performance based pay, and that CEOs with a higher rate of time preference are more likely to be paid in salary. Other related papers on the effects of managerial biases and personal characteristics on corporate decisions and outcomes include Brown and Sarma (2007) and Doukas and Petmezas (2007) on the impact on acquisitions, and Hribar and Yang (2011) on the impact on forecast behavior and earnings management. Hilary, Hsu, and Segal (2011) provide evidence that CEOs become more optimistic after a series of past successes and that more optimistic CEOs appear to exert greater effort. Campbell, Gallmeyer, Johnson, Rutherford, and Stanley (2011) provide evidence on the influence on CEO turnover, and Hackbarth (2008, 2009) examines the implications for capital structure decisions. Keiber (2005) considers a setting in which both the principal and the agent are overconfident, and Gervais and Goldstein (2007) show how agents who overestimate the marginal productivity of their effort can ameliorate free-rider and effort coordination problems. Kaplan, Klebanov, and Sorensen (2011) investigate which CEO characteristics are related to hiring decisions, investment decisions, and firm performance.

Potential explanations for why agents with biased beliefs may rise to the rank of CEO in the first place are provided, for example, by Englmaier (2007, 2010, 2011) and Goel and Thakor (2008). Furthermore, a large literature in psychology documents a widespread tendency in all humans to be overly optimistic regarding their abilities and their future. As Taylor and Brown (1988, p. 197) summarize: "a great deal of research in social, personality, clinical, and developmental psychology documents that normal individuals possess unrealistically positive views of themselves, an exaggerated belief in their ability to control the environment, and a view of the future that maintains that their future will be far better than the average person's." Evidence that such biases extend to management students, entrepreneurs, and corporate presidents is provided, for example, by Camerer and Lovallo (1999), Cooper, Woo, and Dunkelberg (1988), and Larwood and Whittaker (1977).

The remainder of the paper is organized as follows. Section 2.2 introduces the model that is used to study the relationship between optimism and optimal compensation schemes. Section 2.3 describes the data. Section 2.4 describes the empirical analysis and presents the results. Section 2.5 discusses potential alternative explanations and robustness checks. Section 2.6 concludes.

## 2.2 The model

### 2.2.1 Setup

This section introduces the model that is used to study the effect of an agent's optimism on the optimal compensation contract. Figure 2.1 depicts an overview. I consider a principal that employs an agent to implement and thereafter work on a two period project.[6] The principal is risk-neutral with utility function $V(\pi) = \pi$, where $\pi$ denotes the principal's final net payoff. The agent is risk-averse with utility function $U(w, c) = u(w) - c$, where $w$ denotes the agent's total wealth at the end of the second period, and $c$ denotes the agent's total effort costs. I assume that $u(w)$ satisfies $u'(w) > 0$, $\lim_{w \to 0} u'(w) = \infty$, $u''(w) < 0$, and $-u''(w)/u'(w) = \gamma/w > 0$, i.e., $u(w)$ satisfies constant relative risk-aversion. Furthermore, I assume that the agent has zero wealth at the beginning of the first period and access to some alternative employment offer that provides utility $\Omega_t$ at time $t$ if accepted. The discount rate is normalized to zero.

The agent's task is to implement the project at time $t = 1$ and later on, at time $t = 2$, to improve the project if this is feasible. Implementing and improving the project costs the agent private costs $c_1 > 0$ and $c_2 > 0$, respectively, but there are no direct costs to the firm. The objective probability that the project is successful is $p \in (0, 1)$ if it is not improved and $p + \Delta$, with $\Delta \in (0, 1 - p)$, if the agent improves the project. Ex-ante, improvement is possible with probability $\delta \in (0, 1)$. The agent believes the probability of success to be $\widehat{p} \in [p, 1 - \Delta)$ if it has not been improved and $\widehat{p} + \Delta$ if it has been improved.

[6] For now, I take the principal's decision to employ a particular agent as given. The question of whether to hire a more or a less optimistic agent is considered in an extension of the model in Appendix 2.C.

Thus, the agent can be either unbiased ($\widehat{p} = p$) or optimistic ($p < \widehat{p} < 1 - \Delta$).[7] However, I will assume that an agent's optimism is not so extreme as to entirely undo the effects of his risk-aversion in the second period.[8] The principal is assumed to have unbiased beliefs. Furthermore, I assume that the principal knows the agent's beliefs, and that the timing of the decisions and events and the different model parameters are common knowledge.

In case of success, the project has payoff $R > 0$ at the end of the second period. The payoff is 0 if the project fails. By assumption, the payoff in case of success is "large enough", so that it is always optimal for the principal to induce the agent to implement and improve the project. In order to compensate the agent, the principal can promise payments to the agent that are contingent on the project's final payoff—the only verifiable information. Note, that in this setting, the optimal contract can be expressed as a fixed salary that is independent of the project's outcome and an additional incentive payment which is contingent on the project's success.[9] Furthermore, I assume that after implementing the project, but before it becomes known whether or not the project can be improved, the agent can sell a fraction $\alpha \in [0, 1]$ of the incentive claim he received in the first period to a risk-neutral, competitive outside investor with unbiased beliefs. The agent cannot commit not to sell, but both implementing the project and selling the incentive claim are observable. These assumptions allow me to study the effect of optimism on the agent's decision to retain his incentive claims and furthermore generate implications on how optimists can be identified empirically. Finally, I assume that the principal has all the bargaining power.

In sum, the sequence of events and decisions is as follows. Just before $t = 1$, the principal offers the agent an unconditional salary $s_1$ and an incentive claim with payoff $b_1$ in case the project succeeds. The agent can either accept or decline the proposed contract. At $t = 1$, if the agent has accepted the contract, he can either implement the project at private cost $c_1$ or not. After implementation, the agent can sell a fraction

[7] In this setup, an optimistic agent thus overestimates the expected benefits of implementing the project and will therefore be more willing to exert effort. This is consistent with the results of Bénabou and Tirole (2002), who show how higher confidence can improve an agent's motivation to undertake projects, and with the findings of Puri and Robinson (2007), who show that optimistic people (except for extreme optimists) work harder.

[8] See Appendix 2.A for a formal statement of this assumption.

[9] A generic contract in the two outcome setting specifies two payments $\omega(R)$ and $\omega(0)$. Without loss of generality, we can express this contract as a fixed payment $s = \omega(0)$ which is independent of the project's outcome and an incentive claim that pays $b = \omega(R) - \omega(0)$ in case the project succeeds.

$\alpha \in [0, 1]$ of his incentive claim to an outside investor. Just before $t = 2$—after observing the agent's implementation and selling decisions and knowing whether or not the project can be improved—the principal can offer the agent an additional fixed payment of $s_2$ and an additional incentive claim with payoff $b_2$ conditional on the project's success. Thereafter, at $t = 2$, the agent chooses whether or not to improve the project at private cost $c_2$ in case improvement is feasible. Finally, at the end of the second period, the project's final payoff is realized and all compensation claims are paid. This sequence of events and decisions is depicted on a time-line in Figure 2.2.

### 2.2.2 Optimal compensation contract

The principal's objective is to find the optimal payment schedule $\{s_1^*, b_1^*, s_2^*, b_2^*\}$ that induces the agent to implement and thereafter improve the project if possible. In the second period, in case the project can be improved, the salary and incentive claim must be chosen to satisfy the agent's participation and incentive compatibility constraints. Both constraints will be binding at the optimum because the agent is risk-averse and the risk-neutral principal has all the bargaining power. This determines the optimal compensation in the second period. In case the project cannot be improved, there is no need to promise additional payments to the agent. Furthermore, since the agent's participation constraint is binding, his expected utility at the beginning of the second period is equal to the utility that can be derived from his outside option—leaving the firm with the compensation claims and cash already in his possession and accepting an alternative offer of employment. Thus, prior to the second period, the agent chooses what fraction of his first-period incentive claims to retain in order to maximize the expected utility that can be derived from his second-period outside option. This in turn determines the optimal fraction of incentives to be sold to the outside investor after implementing the project. Finally, anticipating the agent's optimal selling decision and the second-period bargaining outcome, the principal chooses the first-period salary and incentive claim to satisfy the agent's ex-ante participation and incentive compatibility constraints at the beginning of principal-agent relationship. Following this procedure, one can show that the optimal compensation contract is as follows.[10]

[10] All derivations can be found in Appendix 2.A.

***Proposition 1: optimal contract for an unbiased agent***

*The optimal contract for an unbiased agent ($\widehat{p} = p$) in case the project can be improved at $t = 2$ is*

$$\begin{aligned} s_1^* &= 0 \\ b_1^* &= \frac{u^{-1}\{\Omega_1 + c_1\}}{p + \delta\Delta} \\ s_2^* &= u^{-1}\left\{\Omega_1 + \Omega_2 + c_1 - p\frac{c_2}{\Delta}\right\} - u^{-1}\{\Omega_1 + c_1\} \\ b_2^* &= u^{-1}\left\{\Omega_1 + \Omega_2 + c_1 + (1-p)\frac{c_2}{\Delta}\right\} - u^{-1}\left\{\Omega_1 + \Omega_2 + c_1 - p\frac{c_2}{\Delta}\right\}. \end{aligned}$$

*In case the project cannot be improved at $t = 2$, $s_1^*$ and $b_1^*$ are unchanged, and $s_2^* = b_2^* = 0$.*

***Proposition 2: optimal contract for a mildly optimistic agent***

*In the first period, a mildly optimistic agent ($p < \widehat{p} \leq p + \delta\Delta$) receives the same contract as an unbiased agent. In the second period, if the project can be improved, the optimal contract is*

$$\begin{aligned} s_2^* &= u^{-1}\left\{\Omega_1 + \Omega_2 + c_1 - \widehat{p}\frac{c_2}{\Delta}\right\} - u^{-1}\{\Omega_1 + c_1\} \\ b_2^* &= u^{-1}\left\{\Omega_1 + \Omega_2 + c_1 + (1-\widehat{p})\frac{c_2}{\Delta}\right\} - u^{-1}\left\{\Omega_1 + \Omega_2 + c_1 - \widehat{p}\frac{c_2}{\Delta}\right\}. \end{aligned}$$

*In case the project cannot be improved, we have $s_2^* = b_2^* = 0$.*

***Proposition 3: optimal contract for a very optimistic agent***

*In the first period, a very optimistic agent ($\widehat{p} > p + \delta\Delta$) receives the same salary as an unbiased agent. The optimal incentive claim is given by*

$$\begin{aligned} b_1^* &\in \{b_1 : \widehat{p}u[\alpha^*(p + \delta\Delta)b_1 + (1-\alpha^*)b_1] + (1-\widehat{p})u[\alpha^*(p+\delta\Delta)b_1] - \Omega_1 - c_1 = 0\} \\ \alpha^* &\in \arg\max_{\alpha\in[0,1]} \{\widehat{p}u[\alpha(p+\delta\Delta)b_1^* + (1-\alpha)b_1^*] + (1-\widehat{p})u[\alpha(p+\delta\Delta)b_1^*] + \Omega_2 - c_1\}. \end{aligned}$$

*In the second period, if the project can be improved, the optimal contract is*

$$\begin{aligned} s_2^* &= u^{-1}\left\{\Omega_1 + \Omega_2 + c_1 - \widehat{p}\frac{c_2}{\Delta}\right\} - \alpha^*(p + \delta\Delta)b_1^* \\ b_2^* &= u^{-1}\left\{\Omega_1 + \Omega_2 + c_1 + (1-\widehat{p})\frac{c_2}{\Delta}\right\} - u^{-1}\left\{\Omega_1 + \Omega_2 + c_1 - \widehat{p}\frac{c_2}{\Delta}\right\} - (1-\alpha^*)b_1^*. \end{aligned}$$

*In case the project cannot be improved, we have $s_2^* = b_2^* = 0$.*

**Discussion**

The optimal salary offered to the agent in the first period is always equal to zero, irrespective of the agent's beliefs. The intuition behind this result is that the agent can convert risky incentive claims granted before the first period into a safe payment by selling the claims to an outside investor after the project has been implemented. Thus, there is no benefit from insuring the agent with a salary. Any fixed payment can be equally provided to the agent by increasing his original incentive claim by an amount which will fetch a price equal to the fixed payment when sold to the outside investor.

With respect to the incentive claim offered to the agent in the first period and the agent's choice of what fraction to sell to the outside investor after implementing the project, two cases can be distinguished. An unbiased or mildly optimistic agent ($\widehat{p} \leq p + \delta\Delta$) is not willing to bear the risk associated with the incentive claim and decides to sell everything to the outside investor after the project has been implemented. When the agent is offered the claim by the principal, he therefore values it at the price that the outsider will be willing to pay because he anticipates his future selling decision. In that case, both the value of the original incentive claim as well as the fraction sold to the outside investor are independent of the agent's beliefs.

If on the other hand the agent is very optimistic ($\widehat{p} > p + \delta\Delta$), he will choose to sell only a fraction $\alpha^* \in (0, 1)$ of his original incentive claim after implementing the project. The optimal fraction to sell in that case is determined by the trade-off between the perceived loss from selling the claim at a price that the agent deems too low and the utility cost of holding on to a risky claim. One can show that both the fraction of claims that the agent sells as well as the amount of incentives promised to the agent are decreasing in the agent's beliefs regarding the probability that the project succeeds.

Regarding the compensation claims offered to the agent in the second period, we can again distinguish between agents that are not very optimistic and therefore sell their entire incentive claim after the first period and agents who are sufficiently optimistic to retain a fraction of the claim. In the former case, the agent does not carry over any incentive claims from the first to the second period. Furthermore, the proceeds that are raised by selling the claim are independent of the agent's beliefs because the value of the original incentive claim depends only on the outsider's beliefs. Thus, the agent's optimism affects his second period compensation only through the overvaluation of newly granted incentive claims. In that case, one can show that both the optimal salary offered to the agent and the optimal incentive payment are decreasing in the agent's beliefs regarding the probability of success.

If on the other hand the agent is very optimistic, he sells only a fraction of his original incentive claim. Thus, at the onset of the second period, the agent is subject to some incentives that are carried over from the first period. However, whether a more optimistic agent accumulates more or fewer claims than a less optimistic agent depends on the net-effect of retaining a larger fraction of a smaller amount of original incentives. Nonetheless, more optimistic agents raise strictly less proceeds from selling claims because an increase in optimism decreases both the amount of original incentives and the fraction of claims that are sold. Thus, if the agent is sufficiently optimistic to retain a fraction of his original incentive claim, his second period compensation is affected not only by the overvaluation of newly granted incentive claims, but also by the amount of accumulated incentives and the amount of proceeds that were raised from selling prior claims. The overvaluation of new contingent claims allows the principal to reduce both the agent's fixed and variable compensation. A larger amount of accumulated incentives reduces the optimal amount of new incentives even further. On the flip side, however, having raised fewer proceeds from selling prior claims increases the amount of fixed compensation that must be granted to the agent. The total effect of the agent's optimism on the different compensation components in the second period thus depends on the relative magnitudes of the overvaluation and accumulation effects and can be either positive or negative.

### 2.2.3 Empirical predictions

The model outlined above implies that the value of the optimal incentive claim in the first period is decreasing in the agent's optimism. This effect is driven by an optimist's overvaluation of contingent claims. In the second period, however, an agent's optimism affects the different compensation components not only through the overvaluation of newly granted incentive claims, but also through the amount of accumulated incentives and the amount of proceeds that were raised by selling claims after the first period. The net-effect of optimism on compensation in the second period thus depends on the aggregation of the two effects. Furthermore, in the data, we are likely to observe the repeated interaction between principals and agents over several, potentially overlapping periods and projects, which will make it difficult to disentangle "first" and "second" periods. Thus, in order to derive testable implications, I focus on the average effect of an agent's optimism. Specifically, I define the probability weighted average effect of an agent's optimism on his incentive compensation as

$$\Upsilon \equiv \frac{1}{1+\delta} \cdot \frac{db_1^*}{d\widehat{p}} + \frac{\delta}{1+\delta} \cdot \frac{db_2^*}{d\widehat{p}},$$

and the probability weighted average effect on his total compensation as

$$\Psi \equiv \frac{1}{1+\delta} \cdot \left( \frac{db_1^*}{d\widehat{p}} + \frac{ds_1^*}{d\widehat{p}} \right) + \frac{\delta}{1+\delta} \cdot \left( \frac{db_2^*}{d\widehat{p}} + \frac{ds_2^*}{d\widehat{p}} \right).$$

Note that the effect of an agent's optimism in the first period is observed with certainty, whereas the effect in the second period is only observed if the project can be improved.

One can show that both $\Upsilon$ and $\Psi$ are negative for agents that sell their entire incentive claim after the first period as well as for agents that retain a fraction of the claim. That is, for both $\widehat{p} \leq p + \delta\Delta$ and for $\widehat{p} > p + \delta\Delta$, we obtain $\Upsilon < 0$ and $\Psi < 0$. Thus, the average effect of an agent's optimism on his incentive compensation as well as on his total compensation is strictly negative.[11] Predictions 1 and 2 summarize this result:

***Prediction 1: lower incentive compensation***

*On average, more optimistic agents receive lower incentive pay than less optimistic agents.*

***Prediction 2: lower total compensation***

*On average, more optimistic agents receive lower total compensation than less optimistic agents.*

The model also implies that more optimistic agents retain a larger fraction of their incentive claims than less optimistic agents. Furthermore, the model implies that optimists overestimate the expected future profits generated by the firm. Rather than tested directly, these implications will be used to construct empirical measures for a given agent's optimism.

[11] Competition among potential employers for the services of an optimist could in principle diminish or even eradicate this effect. However, if the agent's optimism is known only to the principal he actually interacts with, or if the agent is optimistic only about the company he actually works for, there will be no competition for his services.

## 2.3 Data

In order to test Predictions 1 and 2, I examine the empirical relationship between optimism and compensation for CEOs of US firms. I assess a given CEO's optimism with two separate measures. The first measure is based on the comparison between the earnings per share (EPS) that were forecast by the firm during the CEO's tenure and the EPS that were eventually realized. The idea behind this approach is that optimistic CEOs overestimate their firm's future performance and should thus be more likely than their peers to release forecasts that exceed the firm's actual EPS. This intuition is consistent with the findings of Hribar and Yang (2011), who provide evidence that CEOs who are described as being optimistic in the financial press are indeed more likely to issue forecasts that exceed the earnings that are eventually realized.[12]

The second measure is based on the CEO's option exercise decisions and follows the rationale proposed by Malmendier and Tate (2005a, 2005b, 2008) and Malmendier, Tate, and Yan (2011). Consistent with the implications of my model, the measure identifies a CEO as optimistic if he holds on to his stock options longer than is expected from a CEO with unbiased beliefs. The intuition behind this approach is that a risk-averse CEO is expected to reduce his exposure to company specific risk by exercising his stock options early if they are sufficiently deep in the money.[13] Thus, holding on to an option until late in the option's life—despite the fact that the option is already deep in the money—is considered evidence for optimistic beliefs about the company's prospects.

I use three main data sources for my empirical analysis: information on the CEOs' compensation from Execucomp, information on the CEOs' option exercises from the Thomson Reuters insider filings database, and information on EPS forecasts, analyst consensus estimates, and realized earnings from the First Call Historical Database. All data on compensation, option exercises, and earnings forecasts are obtained for the years between 1996 and 2005.[14] Furthermore, I obtain financial information from the CRSP and Compustat databases and data on the firms' board characteristics from the

[12] Note that while the CEO may not personally compute and announce the forecast, it is unlikely that the CEO would tolerate the release of a forecast that he strongly disagrees with.

[13] See, for example, Hall and Murphy (2002) for a theoretical framework and Huddart and Lang (1996) for empirical evidence.

[14] Information on the CEOs' option exercises as recorded in the table pertaining to derivative transactions in the Thomson Reuters insider filings database is available only from 1996 onwards. Information on the Black-Scholes values of the CEOs' option grants is available from the Execucomp database only until 2005 due to changes in the reporting requirements for equity based compensation (FASB123).

RiskMetrics database.

### 2.3.1 Optimism measure based on EPS forecasts

The first measure for a CEO's optimism is based on the comparison of the EPS forecasts released by the firm with the EPS that were eventually realized.[15] I begin with all company issued EPS forecasts in the First Call Historical Database that were announced between January 1996 and December 2005. I keep only forecasts for the common stock of each firm and drop observations if the announcement date falls on or after the end of the fiscal period for which the announcement was made or on or after the date on which the actual EPS were announced. Furthermore, I drop observations if any of these three dates is missing, or if information on the EPS that were eventually realized is not available. On average, the forecasts are announced 91 days before the end of the relevant fiscal period. In case of multiple forecasts for the same fiscal period, I keep only the last forecast, and if an EPS range was announced, I use the midpoint of the range.

For each forecast and realization pair, I then assign a dummy that takes the value 1 if the forecast EPS exceed the EPS that were eventually realized. Thereafter, for each year and each firm, I average the dummies across all forecast-realization pairs, thus calculating the fraction of forecasts within each year that were higher than the actual EPS. For each CEO-firm combination, I then calculate the equally weighted average of these fractions across all years. This procedure leads to the variable HighForecast which can take on values between 0 and 1. HighForecast is equal to 0 if all EPS forecasts are lower than the EPS that are eventually realized. It is equal to 1 if all forecasts are higher than the actual EPS. Thus, higher values of the variable HighForecast are indicative of more optimistic beliefs, as higher values denote a larger fraction of forecasts that ex-post appear to be too high.

### 2.3.2 Optimism measure based on option exercise decisions

The second measure is based on the CEO's option exercise decisions and follows the rationale proposed by Malmendier and Tate (2005a, 2005b, 2008) and Malmendier, Tate, and Yan (2011). Information on the CEOs' option exercises is obtained from the Thom-

[15] As a robustness check, I compute an alternative version of this measure by comparing the firm's forecasts with the corresponding analyst consensus forecasts. The results of this analysis are presented in Section 2.5.2.

son Reuters insider filings database. The data files are designed to capture all insider activity as reported on the SEC forms 3, 4, 5, and 144 and include additional information concerning the accuracy of the reported data in the form of a cleanse indicator that denotes the overall level of confidence in each record. Corporate insiders—individuals who have access to non-public, material, insider information—including the CEO are required to file forms 3, 4, and 5 for transactions involving their companies' stock. For my analysis, form 4 is the relevant source of information as it indicates changes in an insider's ownership position. This could be a purchase, sale, option grant or exercise, or any other transaction that causes a change in the ownership position.

I start with all form 4 observations between January 1996 and December 2005 and keep only observations that pertain to exercises of incentive stock options by CEOs and that have cleanse indicators R, H, C, L, or I, indicating a reasonable level of confidence in the accuracy of the data.[16] Furthermore, I discard observations if the person ID that uniquely identifies each CEO, the transaction date, the expiration date of the options, or information on the number of securities exchanged in the transaction, the transaction price adjusted for stock splits, or the share price on the transaction date is missing. As a final check, I make use of the fact that option exercises are recorded in two separate tables and keep only those observations that are listed in both tables with the same transaction price. After these steps, I am left with a "clean" list of all exercises of incentive stock options.

For all exercise observations, I first calculate the time to expiration at the time of exercise as the difference between the expiration date of the options and the transaction date.[17] Each observation is then matched with the annual closing price of the underlying stock at the end of the preceding calendar year, which I obtain from the CRSP database.[18] I keep only those observations for which price information is available and calculate the moneyness of the options at the end of the previous year as the difference between the closing price of the preceding calendar year and the exercise price divided by the exercise price. All prices are adjusted for stock splits, and observations where the

[16] A description of the different cleanse indicators is provided in Appendix 2.B.

[17] I drop twenty observations with a reported expiration date before the transaction date and four observations with an implied time to expiration of more than 200 years as these are clearly data entry errors.

[18] Matching observations with the stock price as of 12 months before the expiration date of the options as in Malmendier and Tate (2005a, 2005b, 2008) and Malmendier, Tate, and Yan (2011) would lead to a significant drop in the percentage of matched observations (68% versus 92%).

exercise price is zero are dropped.

Then, for each observation, I assign an optimism dummy that takes the value 1 if the options were exercised within one year of their expiration date and at least 40% in the money at the end of the preceding year.[19] Otherwise, the dummy takes the value 0. Finally, I average the value of the optimism dummy for each CEO across all observations that pertain to that CEO within a given firm, weighting each exercise observation by the number of options that were exercised.[20] This procedure leads to the variable LongHolder which can take on values between 0 and 1—with higher values indicating more optimistic beliefs.

### 2.3.3 Compensation and CEO and firm characteristics

Information on the CEOs' compensation as well as on their holdings of company stock and options is obtained from the Execucomp database and matched with the information on the CEOs' optimism. Moreover, I obtain financial and balance sheet information as well as information on the firms' board composition from the CRSP, Compustat, and RiskMetrics databases. For each CEO-firm combination, I calculate the firm's market capitalization, leverage, and market-to-book ratio, as well as the firm's cash holdings and R&D and capital expenditures scaled by total assets at the end of the year that precedes the year of the CEO's appointment. Furthermore, I compute the standard deviation of the firm's monthly stock returns during the five years before the appointment. Leverage is calculated as total long term debt divided by total assets. The market-to-book ratio is calculated as the sum of the firm's market capitalization and total long term debt divided by total assets. In addition, for each firm and in each year, I compute the firm's stock return and return on assets (EBIT divided by total assets), as well as the total number of directors and the fraction of independent directors on the firm's board.

I drop observations if there is no information on the CEO's total compensation, salary, or bonus, the Black-Scholes value of option awards or value of restricted stock grants, or if the indicated value of the CEO's total compensation is zero. I also drop one observation for which the sum of the CEO's bonus payments and option and stock grants

[19] My analyses are not sensitive to this cut-off. Using 20% or 60% instead of 40% yields similar results. This finding resembles the results in Malmendier and Tate (2008).

[20] Weighting observations by the profit that was realized in the transaction—calculated as the product of the number of shares exchanged in the transaction and the difference between the share price on the transaction date and the exercise price—or giving equal weight to all observations leads to similar results.

exceeds the indicated value of his total compensation. Furthermore, I drop observations if information on the CEO's tenure, age, or gender is not available, or if the indicated values of tenure or age are negative. In case the variable "age" is missing in the Execucomp data, but can be recovered using information from prior or subsequent years, I do not drop the observation. Finally, I drop observations for which neither optimism measure is available, or if the CEO has neither received any incentive stock options during the current year nor in any preceding sample year. In that case an optimistic CEO cannot hold on to his options or overestimate their value as is implied by my model.[21] After these steps, I am left with a final sample of 11,477 observations, covering 2,559 CEOs and 1,889 firms. 601 of these firms change their CEO at least once during the sample period. However, of the 2,559 CEOs, I observe only 27 as CEO in more than one firm.

## 2.4 Empirical analysis and results

### 2.4.1 Summary statistics

Table 2.1 presents summary statistics for the final sample of 11,477 observations. Information on the CEOs' compensation is presented in Panel A, information on the CEOs' tenure, age, and gender as well as on the two optimism measures HighForecast and LongHolder is presented in Panel B. The average (median) total compensation per year is about \$5.7 (\$2.9) million. The standard deviation is large (\$11.9 million) and the maximum exceeds \$600 million. The mean (median) salary, bonus, and value of restricted stock grants are \$0.67 (\$0.62), \$0.85 (\$0.45), and \$0.56 (\$0) million per year, respectively. The average (median) Black-Scholes value of option grants is \$3.1 (\$1.0) million. On average, the CEOs in the sample receive 65% of their total compensation in the form of incentive pay, i.e., bonus, restricted stock, and stock options. The median is 71%.

The average (median) tenure and age of the CEOs is 7 (5) and 55 (55) years, respectively, and 98% of the observations pertain to male CEOs. The mean (median) value of the variable HighForecast across all observations is 0.53 (0.50), indicating that on average the CEOs meet or beat their earnings forecasts almost as frequently as they miss them. The average value of the optimism measure LongHolder across all observations is

[21] If I keep these observations, the empirical results are weaker, but qualitatively unchanged.

0.32. The median is 0. The standard deviation of the variable HighForecast across all observations is 0.36, and the standard deviation of LongHolder is 0.41.[22] The correlation coefficient between HighForecast and LongHolder across all CEO-firm combinations is 0.065 and significant at the 5% level. Thus, those CEOs that are more prone to making forecasts that are too high are also more likely to hold on longer to their in-the-money options.

Summary statistics for the number of forecast observations as well as information on the distribution of the optimism measure HighForecast are presented in Panel C. The mean (median) number of EPS forecast observations per CEO-firm combination is 6.7 (4.0), and the maximum is 35. For 20% of all CEO-firm combinations, the forecast EPS are always lower than or equal to the EPS that were eventually realized (HighForecast = 0), and for 26% of all CEO-firm combinations, the forecast earnings always exceed the actual earnings (HighForecast = 1). For the majority of CEO-firm combinations (54%), the forecast EPS are sometimes too high and sometimes too low ($0 <$ HighForecast $< 1$).

Panel D presents summary statistics for the number of exercise observations that I observe for each CEO-firm combination as well as information on the distribution of the optimism measure LongHolder. On average, there are eight exercise decisions for each CEO-firm combination in the sample. The median number of observations is four and the maximum as high as 161. For 55% of all CEO-firm combinations the value of LongHolder is zero, i.e., none of the options exercised by the CEO were exercised within one year of their expiration date and were at least 40% in the money at the end of the preceding year. For 17% of all CEO-firm combinations the value of LongHolder is one, i.e., all options where exercised within one year of their expiration date and all of them were at least 40% in the money at the end of the year that precedes the exercise date. Thus, for 72% of all CEO-firm combinations, the CEO exercises either always or never late. Changes in the exercise behavior of a given CEO in a given firm are observed for only 28% of all CEO-firm pairs.

[22] The standard deviation of the optimism measure HighForecast between firms is 0.33, and the within-firm standard deviation is 0.15. For the variable LongHolder, the standard deviation between firms is 0.39, and the within-firm standard deviation is 0.11.

### 2.4.2 Regression analyses

#### CEO selection and firm characteristics

This section presents the results of regression analyses concerning the effect of a CEO's optimism on the different components of his compensation as well as on his total compensation. A natural concern regarding these analyses is that optimistic CEOs are not randomly assigned to the companies they work for. Different firms may have different levels of "preferred optimism" and appoint their CEOs accordingly. In particular, firms may face a trade-off between the reduction in compensation costs for an optimistic CEO and the potential value destruction due to the suboptimal selection of investment projects.[23] Differences in firm characteristics may therefore lead to differences in the preferred levels of optimism which are correlated with the firm level determinants of the CEO's compensation.

I consider this trade-off between compensation reduction and value destruction in an extension of my model in Appendix 2.C. The intuition behind the results is as follows. The principal prefers an unbiased to an optimistic agent, if the reduction in firm value due to the implementation of bad projects exceeds the reduction in compensation costs due to the agent's optimism. However, the principal prefers an optimistic agent if the set of implementable projects can be restricted ex-ante to include only good projects or if a compensation contract can be designed so that the agent chooses to implement only good projects. Whether or not the principal prefers to hire an unbiased or an optimistic agent thus depends crucially on how much discretion in the project selection phase must be left to the agent and how much damage the agent can cause by implementing a bad project. The easier it is to distinguish good from bad projects, the more observable the agent's actions are, and the more control mechanisms can be put in place to reject projects that the agent proposes for implementation, the more likely it is that the principal prefers an optimistic agent. If, however, selecting the "right" project is important and must be left at the agent's discretion, the principal is more likely to prefer an unbiased agent. This reasoning suggests that the decision to hire a more or a less optimistic agent is related

[23] In the model presented in Section 2.2, the agent's task was to implement and improve a single, given project. Moreover, the project's payoff in case of success was assumed to be "large enough", so that it was always efficient to implement and thereafter improve the project. Hence, the value of the firm was monotonically increasing in the agent's optimism. However, if the agent's task is to choose between several different projects—value increasing "good" ones and value decreasing "bad" ones—interior levels of optimism may be optimal.

to the ease of distinguishing between good and bad projects, the potential damage that can be done by implementing bad projects, the observability of the agent's actions, and the discretion that must be left to the agent.

Table 2.2 displays a comparison of firm characteristics for companies that hire optimistic or non-optimistic CEOs (Panel A), as well as for firms that change to a new CEO that is more optimistic or less optimistic than the firm's old CEO (Panel B).[24] All characteristics are measured at the end of the year preceding the (new) CEO's appointment. Panel A reveals that firms that hire optimistic CEOs on average have a lower market-to-book ratio, a lower standard deviation of stock returns, hold less cash (scaled by total assets), and have lower R&D expenditures (scaled by total assets) than firms that hire non-optimistic CEOs.[25] To the extent that more R&D intensive firms, firms with more growth opportunities, and firms with more volatile stock returns are firms for which project selection is particularly important while distinguishing between good and bad projects is particularly difficult, these results are consistent with the intuition outlined above. Furthermore, CEOs in firms with larger cash holdings may have more discretion to implement projects without the approval of the providers of outside financing, which may explain why firms with larger cash holdings appear to be less likely to hire optimists.

Focussing on companies that change their CEOs, Panel B reveals that the differences in firm characteristics are much less pronounced between firms changing to a new CEO that is more optimistic than the old CEO and those changing to a less optimistic CEO. The average market-to-book ratios and cash holdings are not significantly different between the two groups of firms. The differences in the standard deviations of the monthly stock returns and the firms' R&D expenditures remain significant—but only at the 10% level. The differences in all other characteristics are not statistically significant.

[24] In Panel A, CEOs for which the optimism measure HighForecast or LongHolder is equal to 1 (0) are classified as optimistic (non-optimistic). Cases for which HighForecast is equal to 1 (0) but LongHolder is equal to 0 (1) are dropped. In Panel B, new CEOs are classified as more (less) optimistic than the old CEO if the value of HighForecast or LongHolder is higher (lower) than for the old CEO. Cases with an increase (decrease) in HighForecast but a decrease (increase) in LongHolder are dropped.

[25] The variable "R&D expenditures divided by total assets" is missing for 53% of the observations in the sample. To avoid dropping such a large fraction of the data, I set missing values equal to zero. Replacing missing values instead with the average R&D intensity of all firms within the same industry (based on the first two digits of the SIC and calculated on a yearly basis) or dropping observations for which the R&D intensity is missing does not change the finding that firms that hire optimistic CEOs have lower R&D intensities than firms that hire non-optimistic CEOs. In the compensation regressions presented in Section 2.4.2, the dummy variable "R&D missing" takes the value 1 if the variable "R&D expenditures divided by total assets" has been set to zero due to a missing value.

Overall, Panel A provides some evidence that firm characteristics that may be related to the ability to limit the damage that a biased agent can cause by implementing value decreasing projects may be associated with the likelihood of hiring a more or a less optimistic CEO. Panel B, however, reveals that there are only few and weakly significant differences between the companies that hire a CEO that is more optimistic than his predecessor and those that hire a less optimistic CEO. Nevertheless, in order to address the concern that each firm appoints its CEO according to its preferred level of optimism, I include a dummy variable for each firm as well as the natural logarithm of the firm's market capitalization, the standard deviation of the monthly stock returns during the last five years, and the firm's leverage, market-to-book ratio, cash holdings, and R&D expenditures—all measured at the end of the year before the CEO was appointed—as control variables in the compensation regressions. Note that this specification models each firm's preferred level of optimism as the sum of two components: a time-invariant, unobservable base level and a time-varying component that can be expressed as a linear function of the included firm characteristics.

An alternative way to address the concern that optimistic CEOs are not randomly assigned would be to estimate a "Heckman style" treatment effects model. However, several aspects render this approach unappealing in my setup. First, the measures of CEO optimism are continuous and using a binary variable for optimistic CEOs instead would lead to a significant loss of information. Second, an incidental parameters problem would prevent me from including firm dummies in the first stage of the selection model. This is particularly unfortunate as unobserved firm characteristics are probably the prime reason for any selection concern in the first place. Third, in the absence of an instrument for CEO optimism, the control function derived from the selection model would amount to nothing more than a nonlinear combination of the control variables which are already included in my specification. For these reasons, I opt to address the selection concern instead by modeling each firm's target level of optimism as described above.

#### Corporate governance and firm performance

A further concern one may have is that differences in governance and firm performance are systematically related to the CEO's option exercise and forecast behavior as well as to his compensation. A powerful board of directors may influence both the CEO's decisions to exercise his stock options and the firm's EPS forecasts. Moreover, some CEOs may receive less compensation than their peers because of their firm's poor performance. To address these concerns, I include the size of each firm's board, the percentage of independent directors, and the CEO's tenure, as well as each firm's stock return and return on assets as additional control variables in the regressions.[26] Finally, I include control variables for the CEO's gender and age as well as dummy variables for each sample year.

### Regression specification

In summary, I estimate regressions of the following form:

$$\begin{aligned} Ln\left(y_{ijt}+1\right) &= \alpha + \beta \cdot OptimismMeasure_{ij} + \gamma' Firm_j + \delta' X_{ij}^{hist.ctrl.} \\ &\quad + \eta' Board_{jt} + \theta' Tenure_{ijt} + \kappa' Performance_{jt} \\ &\quad + \lambda \cdot Gender_i + \mu' Age_{it} + \rho' Year_t + \varepsilon_{ijt}, \end{aligned}$$

where $i$, $j$ and $t$ denote CEOs, firms, and years.

Using $Ln\left(y+1\right)$ as the dependent variable, where $y$ denotes the compensation variable of interest (in USD '000), allows me to include observations where the value of the compensation variable is equal to zero.[27] OptimismMeasure is the measure of CEO optimism (either HighForecast or LongHolder). $X^{hist.ctrl.}$ is the vector of time-varying firm characteristics which are measured at the end of the year that precedes the CEO's appointment.[28] Board is the vector of board characteristics and Performance is the vector of each firm's stock return during the fiscal year and return on assets (EBIT divided by total assets). Firm, Year, Age, and Tenure are vectors of firm, year, age, and tenure dummies.[29] Gender is a dummy for male CEOs. I include age and tenure

[26] Untabulated regressions reveal that additionally including the G-Index of Gompers, Ishii, and Metrick (2003), the E-Index of Bebchuk, Cohen, and Ferrell (2009), or the number of years since the firm's IPO ("firm age") has virtually no effect on the estimation results.

[27] Untabulated regressions using $Ln\left(y\right)$ for $y > 0$ as the dependent variable confirm my main findings. Furthermore, regressions in which I replace the dependent variable with a dummy that takes the value 1 if $y > 0$ provide some evidence that optimistic CEOs are less likely than their peers to receive option grants and bonus payments.

[28] I do not include the contemporaneous values of these variables because I aim to capture each firm's characteristics at the time when the CEO was appointed. However, untabulated robustness tests confirm that including the contemporaneous instead of the "historical" values of these variables does not change the results.

[29] The first age dummy takes the value 1 if the CEO's age is 40 years, the second takes the value 1 if the CEO's age is 41 years, and so on. Finally, the 32nd dummy takes the value 1 if the CEO's age is above 70 years (1.5% of all observations). I do not include a dummy for CEOs who are less than 40

dummies rather than linear and quadratic terms to allow for a more general relationship between these variables and the CEO's compensation. The estimation results, however, are not sensitive to this choice of specification. Finally, to account for heterogeneity and correlation of the error terms across observations that pertain to the same CEO-firm combination, I calculate heterogeneity robust standard errors that allow for clustering at the CEO-firm level in all specifications.

### The effect of CEO optimism on CEO compensation

Table 2.3 presents the results regarding the effect of a CEO's optimism on the different components of his compensation as well as on his total compensation. Panel A displays the results for the regressions using the optimism measure HighForecast. Panel B displays the results using LongHolder. The first column in both panels reveals a negative and substantial association between the CEO's optimism and the Black-Scholes value of his option grants. The coefficient estimate on HighForecast is -0.804, and the estimate for LongHolder is -0.824. Both are significant at the 1% level. These results can be interpreted as evidence that CEOs that are more likely to announce EPS forecasts that prove to be too high ex-post and CEOs that are more prone to holding on to their stock options despite the fact that the options are already deep in the money indeed receive lower valued option grants than their peers. The coefficient estimates imply that an increase in the value of HighForecast (LongHolder) by one within-firm standard deviation leads to a decrease of about 11% (9%) in the Black-Scholes value of the CEO's option grants. Thus, the regression results are supportive of Prediction 1 and indicative of a negative relationship between a CEO's optimism and the value of his option awards that is both statistically and economically significant.

Regarding the value of restricted stock grants, neither Panel A nor Panel B provide evidence for a significant effect of the CEO's optimism. The coefficient estimate on the optimism measure HighForecast in the second column of Panel A is -0.075. The estimate for LongHolder in Panel B is 0.479. Neither estimate is statistically significant at any conventional level. However, for more than 70% of the observations in the sample, the CEO does not receive any restricted stock grants at all. Untabulated regressions in

years of age (1.2% of all observations). The first tenure dummy takes the value 1 if the CEO's tenure is 1 year, the second takes the value 1 if the CEO's tenure is two years, and so on. Finally, the 21st dummy takes the value 1 if the CEO's tenure is more than 20 years (4.9% of all observations in my sample). I do not include a dummy for the year in which the CEO is appointed (tenure = 0).

which I replace $Ln\,(y+1)$ with $Ln\,(y)$ for $y>0$ provide some, albeit weak evidence that conditional on receiving restricted stock grants, the value of these grants tends to be lower for optimistic CEOs than for their peers.

The third column of Table 2.3 presents the results for the regressions regarding the amount of bonus payments that the CEO receives. Both panels provide further evidence in support of Prediction 1. The coefficient estimates on the optimism measures are negative and significant in Panels A and B, resembling the results for the value of the options that are granted to the CEO. The estimated coefficient on HighForecast is -0.703 and significant at the 1% level (Panel A). The estimate for LongHolder is -0.577 and significant at the 5% level (Panel B). This finding is consistent with optimistic CEOs accepting bonus schemes in the past which are contingent on performance targets that prove to be too high today. The point estimate of -0.703 (-0.577) for the coefficient on HighForecast (LongHolder) in Panel A (B) implies a reduction of around 10% (6%) in the amount of bonus payments for an increase in the value of HighForecast (LongHolder) by one within-firm standard deviation. This indicates an economically significant effect of optimism on the amount of bonus payments that the CEO receives.

Column 4 shows the results for the effect on the CEO's salary. The coefficient estimate on the optimism measure HighForecast in Panel A is negative (-0.122), but not significantly different from zero. The coefficient estimate on LongHolder in Panel B, however, is negative (-0.443) and significant at the 1% level. Overall, this finding may be interpreted as some weak evidence that there may be a negative relationship between a CEO's optimism and his yearly salary.[30]

Finally, the fifth column of Table 2.3 presents the results for the effect on the CEO's total compensation. Both panels reveal negative and significant coefficient estimates for the optimism measures HighForecast (Panel A) and LongHolder (Panel B). The point estimate for HighForecast is -0.231 and significant at the 1% level, implying a reduction in the CEO's total compensation of around 3% for an increase by one within-firm standard deviation in the variable HighForecast. The coefficient estimate on LongHolder is -0.190, significant at the 5% level, and implies a reduction by about 2% for an increase in the optimism measure by one within-firm standard deviation. Thus, both panels provide evidence for a negative effect of a CEO's optimism on his total compensation and are

[30] The point estimate of -0.443 in Panel B implies a reduction in the CEO's salary by about 5% for an increase in the optimism measure LongHolder by one within-firm standard deviation.

supportive of Prediction 2. The negative association between a CEO's optimism and his total compensation is of course not entirely surprising given the results regarding the negative impact of optimism on the value of the option grants, bonus payments, and the CEO's salary.

### Option characteristics for optimistic and non-optimistic CEOs

Given the evidence that optimistic CEOs receive lower valued option grants than their peers, I further examine the characteristics of the awarded options. Using information obtained from the Execucomp database, I compute the average Black-Scholes value of the option grants as well as the average number of options awarded per grant for each CEO-firm combination in the sample. Furthermore, I compute the average maturity and moneyness of the options, weighting each grant observation by the number of options that were awarded.[31] In addition, using the insider filings data obtained from Thomson Reuters, I compute the average number of years between the vesting date of the options and their expiration date (Exercise window) as well as the average number of years that the CEO waited after the vesting date before exercising his options (Waited until exercised). As before, observations are weighted by the number of exercised options.

Table 2.4 presents summary statistics for these variables for optimistic and non-optimistic CEOs.[32] As can be seen from the first two rows in both panels, the average option grant awarded to an optimist has a lower Black-Scholes value and contains fewer options than the average grant awarded to a non-optimist. Both findings are consistent with the results of the multivariate regressions presented before. On average, the granted options have a maturity that exceeds nine years and are slightly out of the money on the day of the grant. While I do not find any evidence for a statistically significant difference in the average moneyness of the options granted to non-optimists and optimists, Panel B shows that the average maturity of the non-optimists' options is larger than the average maturity of the optimists' options. However, the difference is economically small—9.4 years versus 9.1 years—and not significant in Panel A. The average time-span between the vesting date of the options and their expiration date is longer than six years for both

[31] Maturity is calculated as the difference in years between the year in which the options were granted and the year in which they expire. Moneyness is the difference between the firm's share price on the grant date and the exercise price divided by the exercise price. To remove the effect of outliers, I winsorize Moneyness at the 1% level.

[32] HighForecast = 1 or HighForecast = 0 in Panel A, and LongHolder = 1 or LongHolder = 0 in Panel B.

optimistic and non-optimistic CEOs. Nonetheless, optimistic CEOs wait significantly longer before exercising their options than non-optimistic CEOs. This holds both for CEOs that are classified based on their forecast behavior (Panel A) as well as for CEOs that are classified based on their exercise behavior (Panel B). On average, non-optimists wait about three and a half years before exercising their options (3.4 years in Panel A and 3.6 years in Panel B), while optimists on average wait four and a half years (Panel A) or six years (Panel B) depending on which measure is used to classify CEOs as either optimistic or non-optimistic.

Overall, the results of this analysis suggest that while the maturity and moneyness of the awarded options are similar for non-optimistic and optimistic CEOs, optimists on average receive smaller and lower valued grants. Moreover, while on average both non-optimists and optimists are free to exercise their options during a six year period, optimistic CEOs decide to wait significantly longer than non-optimistic CEOs to actually do so.

## 2.5 Alternative explanations and robustness checks

### 2.5.1 Alternative explanations for the late exercising of options

A potential concern may be that the optimism measure LongHolder is confounded by variables other than optimism that influence the CEO's exercise behavior.[33] High dividend yields, board pressure, or inside information, for example, may cause some CEOs to exercise their options later than their peers. Moreover, some CEOs may simply procrastinate and therefore exercise their options at the last moment before they expire.

However, while such circumstances may influence the exercise behavior of the CEOs, it is not clear that they will bias the results of the subsequent analyses. To the extent that dividend yields, board pressure, and the access to inside information are time-invariant firm level characteristics, they will be absorbed by the firm fixed effects in the compensation regressions.[34]

[33] Malmendier and Tate (2005a, 2008) and Malmendier, Tate, and Yan (2011) provide a detailed discussion.

[34] Indeed, in unreported conditional logit models with firm fixed effects, I do not find any evidence that a firm's dividend yield or the size of the board and the percentage of inside directors have a significant influence on the decision to hold in-the-money options until the last year before expiration. Dividend yields are calculated as the value of the dividends paid in a given year divided by the stock price at the end of the previous year. Unreported regressions furthermore confirm that including a firm's dividend

Regarding the effect of inside information, Malmendier and Tate (2005a, 2005b, 2008) and Malmendier, Tate, and Yan (2011) show that, on average, the CEOs do not profit from holding on to their options and would have been better off by exercising earlier and investing the proceeds in the stock market. This finding is inconsistent with an alternative story that explains the decision to hold on to the options with inside information. Consistent with these results, I find that in my sample the options that were exercised "late" by the CEOs were on average deeper in the money at the end of the preceding year than on the exercise date. Thus, the CEOs would have been better off by exercising earlier than by holding on to the options, which is inconsistent with an explanation based on inside information.[35]

Concerning procrastination as an alternative explanation for the late exercising of the options, I examine whether or not the CEOs have filed any other insider transactions in the year (the two years) prior to the exercise observations. In 73% (82%) of all cases in which an option exercise satisfies the LongHolder criteria, the CEO has filed at least one other transaction in the prior year (the two prior years). This result resembles the findings in Malmendier and Tate (2008). Moreover, these percentages are the same for exercise observations that do not fulfill the LongHolder criteria. Thus, there does not appear to be any evidence that the CEOs simply procrastinate when it comes to exercising their options.

Finally, one may be concerned that some CEOs may be more risk-tolerant or more diversified than others and therefore hold on longer to their in-the-money options. These concerns are particularly hard to tackle as I have little means to directly assess a given CEO's risk-aversion nor do I observe the CEO's entire wealth portfolio. However, additional analyses based on the CEOs' holdings of company stock and options and the fraction of incentives in the CEOs' total compensation that are presented in Section 2.5.4 provide evidence that the empirical findings are unlikely to be explained by systematic differences in CEOs' diversification or risk-tolerance.

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yield in each year as an additional control variable in the compensation regressions reported in Section 2.4.2 does not change the results.

[35] Both findings are consistent with the results of Jenter (2005), who uses insider trading patterns to identify divergences in top managers' perceptions of fundamental value and market valuations and finds little evidence that the use of inside information can explain the trading behavior.

### 2.5.2 Earnings targets, EPS forecasts, and CEO compensation

Regarding the evidence for a negative relationship between the fraction of EPS forecasts that exceed the EPS that are eventually realized and the CEO's compensation, one may be concerned that it is precisely because a forecast was not met that the CEO receives lower pay as some form of punishment. This explanation is consistent with a negative effect of the CEO's optimism on his compensation if his optimism leads the CEO to agree to performance targets that prove to be too high ex-post. However, the same result may obtain if the CEO's compensation in a given year depends on whether or not the firm meets its own earnings forecast, and all CEOs are unbiased and randomly miss or beat their forecasts with equal probability. In such a setting, in each year some CEOs would miss their forecasts and therefore receive lower pay—and ex-post they would appear to be optimistic.

The fact that the variable HighForecast is not the fraction of earnings forecasts that were too high during the year under consideration, but a weighted average of the fraction of exceedingly high forecasts across all years, mitigates this concern. If the CEOs truly miss or beat their EPS forecasts with equal probability, then the value of HighForecast would tend towards 0.5 for all CEOs. While the CEOs compensation in each year would be negatively related to the fraction of missed forecasts in that particular year, it would be unrelated to the variable HighForecast, which measures the average fraction of forecasts that proved to be too high across all years. Nonetheless, the nature of my data allows for several additional analyses.

#### Beating salient earnings benchmarks

One way to address the aforementioned concern that some CEOs receive less compensation because the realized earnings fall short of the firms' earnings targets is to construct control variables that indicate whether or not the firms' EPS exceed various EPS benchmarks. Two salient benchmarks are the EPS that were realized during the prior year and the analyst consensus forecast for the firm's earnings.[36] In order to construct the control variables, I first define dummy variables that take the value 1 if the EPS in a given quarter exceed the EPS that were realized during the same quarter of the prior

[36] Matsunaga and Park (2001), for example, show that failing to meet quarterly analyst forecasts or the earnings for the same quarter of the prior year has a significant negative effect on the CEO's bonus payments over and above the direct effect of the firm's poor performance.

year. Similarly, I define dummy variables that take the value 1 if the realized EPS in a given quarter exceed the analyst consensus forecast for this quarter.[37] For each firm and in each year, I then compute the average of the dummy variables indicating whether or not the EPS exceed the last year's EPS as well as the average of the dummy variables indicating whether or not the EPS exceed the analyst consensus forecast. I denote these averages BeatLastYearEPS and BeatConsensusEstimate, respectively.

Table 2.5 displays the results of regressions in which BeatLastYearEPS and BeatConsensusEstimate have been added as additional control variables. Panel A displays the results using the optimism measure HighForecast, and Panel B displays the results for the optimism measure LongHolder. As before, the coefficient estimates on the optimism measures in both panels are negative and significant in the regressions pertaining to the CEOs' option grants, bonus payments, and total compensation. Including the variables BeatLastYearEPS and BeatConsensusEstimate to control for whether or not a firm's realized earnings exceed salient EPS benchmarks does not drive out the negative and significant association between the measures of CEO optimism and the CEOs' incentive and total compensation. These results thus suggest that the lower pay of CEOs that systematically issue optimistic EPS forecasts is not just driven by negative shocks to the firms' earnings that make the forecasts look optimistic ex-post and also lead to lower compensation.

#### Optimism measure based on analyst consensus estimates

A second possibility to address the concern that some CEOs receive less compensation because the realized earnings fall short of the forecast earnings is to construct an alternative optimism measure. The optimism measure HighForecast is based on the comparison of the EPS forecasts that were issued by a firm and the EPS that were eventually realized. Alternatively, I can construct an optimism measure by comparing the earnings that were forecast by the firm with the corresponding analyst consensus forecast. That

[37] In order to construct the analyst consensus estimates, I first obtain all analyst forecasts from the First Call Historical Database that were issued during the sample period. As for the forecasts issued by the firms, I keep only analyst forecasts for the common stock of each firm and drop observations if the forecast date falls on or after the end of the fiscal period for which the forecast was made or if either date is missing. In case a broker issues multiple forecasts for the same fiscal period, I keep only the latest forecast. Furthermore, I drop observations if the broker ID that uniquely identifies each forecast issuer is missing. Finally, I keep only forecasts that were issued at least 30 days before the end of the fiscal period and require that at least three analyst forecasts are available. I then calculate the equally weighted average analyst forecast for each firm and fiscal period combination.

is, when determining whether or not a forecast issued by a firm was optimistic, instead of examining if the forecast was higher or lower than the ex-post realized EPS, I examine whether or not the firm's forecast was higher or lower than the average analyst forecast. The merit of this procedure is that it identifies those CEOs as optimistic that systematically issue forecasts that are higher than the corresponding analyst consensus forecasts. Thus, the measure does not rely on the ex-post comparison of forecasts and realizations, but rather upon the comparison of different forecasts that were issued before the actual earnings were realized.

In order to construct this measure, I merge the analyst consensus forecasts with the corresponding EPS forecasts issued by each firm and assign a dummy that takes the value 1 if the forecast issued by the firm exceeds the analyst consensus forecast. Then, for each firm and in each year, I average these dummies across all consensus and firm forecast pairs. For each firm-year combination, this procedure results in the fraction of EPS forecasts issued by the firm that were higher than the corresponding analyst consensus forecast. Finally, for each CEO-firm combination, I calculate the equally weighted average of these fractions across all years. The resulting variable, denoted ExceedConsensus, can take on values between 0 and 1. ExceedConsensus is equal to 0 if all company issued forecasts were lower than the corresponding average analyst forecast. It is equal to 1 if all forecasts issued by the firm exceed the corresponding analyst consensus forecast. Thus, higher values of the variable ExceedConsensus are indicative of more optimistic beliefs.

Table 2.6 displays the results of regressions in which the variable HighForecast has been replaced by the variable ExceedConsensus. The first row reveals negative and significant coefficient estimates on the optimism measure ExceedConsensus in the regressions regarding the CEO's option grants and total compensation. These results provide further evidence that optimistic CEOs receive less incentive and total compensation than their peers and thus are supportive of Predictions 1 and 2. The findings further suggest that the lower compensation of optimistic CEOs is not simply driven by unexpected, negative shocks to a firm's earnings that cause the realized EPS to fall short of the forecast EPS.

#### Optimism measures based on future earnings forecasts

Finally, in the regression relating the value of the option grants in each year to the CEO's optimism, I can replace the variable HighForecast with the average fraction of EPS forecasts that are too high in the next year only (NextYearHigh) or with the average fraction of forecasts in all future years that are too high (AvgFutureHigh). Clearly, it cannot be the case that a CEO receives fewer stock options today as a punishment for missing a forecast in the future, which has not even been issued yet. At the same time—as predicted by the model—an optimistic CEO may accept a smaller option grant today because he overestimates the value of the options. Furthermore, if his optimism is stable over time it will be reflected by the fraction of EPS forecasts that exceed the actual EPS in the future.[38]

Table 2.7 presents the results of this robustness check. The first column displays the results for the regression in which the variable HighForecast has been replaced with the variable NextYearHigh. The second column reports the results for AvgFutureHigh. In both columns, the coefficient estimates on the optimism measures are negative and significant. These findings confirm the results of the previous analyses and suggest that the CEOs are not simply punished for missing a given earnings target.

### 2.5.3 CEO optimism, pessimism, and overconfidence

The evidence that optimistic CEOs appear to receive less compensation than their peers naturally leads to the following question. What about pessimistic CEOs? Should we expect that pessimists receive higher compensation than their peers, or are biased beliefs in either direction associated with lower pay? In fact, one may be concerned that biased beliefs in general are a sign of lower talent and may therefore lead to lower compensation. Furthermore, differences in the level of confidence that each CEO has in the earnings forecasts may play a role. Gervais, Heaton, and Odean (2011), for example, show how the optimal compensation arrangement is influenced by overconfidence, so controlling for a CEO's (over-)confidence could potentially affect the estimation results.[39]

[38] Note that this logic does not extend to bonus payments because the CEO cannot overestimate their value once the payments have been made.

[39] As mentioned in the introduction, the distinction between overconfidence and optimism is sometimes blurred in the literature. Here, an agent is considered overconfident if he believes that information he possesses is more precise than it really is. An optimist, however, simply believes that good outcomes are more likely than they really are.

In order to address these concerns, I define two new dummy variables for all CEOs in the sample. “Optimist” takes the value 1 if all EPS forecasts during a CEO’s tenure are higher than the EPS that are eventually realized. “Pessimist” takes the value 1 if all forecasts are lower than the actual earnings. Thus, all CEOs are classified as either optimistic, pessimistic, or neither. Furthermore, in order to assess a given CEO’s confidence in the earnings forecasts, I compute a measure that is based on the relative width of the forecast EPS ranges. The intuition behind this approach is that a more confident CEO should be more likely to issue a narrower forecast range or even a point estimate. Therefore, for each EPS forecast I calculate the relative width of the forecast range as the difference between the upper and the lower forecast bound divided by the midpoint of the range. If the forecast is a point estimate, I set the relative width to zero. For each firm and in each year, I then calculate the average relative forecast width. Thereafter, I calculate the equally weighted average of the yearly averages for each CEO-firm combination. The resulting variable, ForecastWidth, is a weighted average of the relative widths of the forecast ranges that were issued during each CEO’s tenure. ForecastWidth is equal to zero if only point estimates were issued and increases in the fraction of forecasts that were issued as an EPS range and in the widths of these ranges. Thus, lower values of ForecastWidth are indicative of more (over-)confidence.

I now re-estimate the regressions reported in Section 2.4.2, replacing the variable HighForecast with the two dummies Optimist and Pessimist and adding ForecastWidth and its squared value as additional control variables.[40] Table 2.8 displays the results. The coefficient estimates on Optimist and Pessimist provide some evidence that biased beliefs are not in general associated with lower compensation. To the contrary, the coefficient estimates on Pessimist are positive and significant in the regressions regarding the CEO’s option grants, bonus payments, and total compensation. The estimated coefficients on Optimist however are negative and significant for the CEO’s option grants as well as for his total compensation. Thus, CEO’s with upward biased beliefs (“optimists”) receive lower compensation than their peers, while CEO’s with downward biased beliefs (“pessimists”) receive higher compensation. These findings are consistent with optimists overestimating and pessimists underestimating the value of their incentive claims. The

[40] To remove the effect of outliers, I winsorize the variable ForecastWidth at the 1% level. The squared value of ForecastWidth is included because the results of Gervais, Heaton, and Odean (2011) suggest that the effect of overconfidence on compensation is non-monotonic.

results are at odds with an alternative explanation in which biases in either direction, i.e., both optimism and pessimism, are a sign of lower talent which in turn leads to lower compensation.

### 2.5.4 Portfolio diversification and risk-tolerance

A further concern one may have is that the estimation results are driven by differences in risk-aversion or portfolio diversification. Some CEOs may be more risk-tolerant than others and therefore hold on longer to their in-the-money options, or they may have invested less of their personal wealth in the firm and therefore benefit less from exercising their options early and diversifying. Finally, some CEOs may use hedging instruments such as zero-cost collars, equity swaps, or forward contracts to reduce their exposure to firm specific risk.

These concerns are particularly hard to tackle because I have little means to directly assess a given CEO's risk-aversion nor do I observe the CEO's entire wealth portfolio. However, the model of Section 2.2 implies that differences in risk-aversion alone cannot explain the observed differences in exercise behavior. Optimism is a necessary condition for the decision to retain incentive claims: for any positive level of risk-aversion, an unbiased agent will always sell his entire claim. Moreover, in unreported conditional logit models with firm fixed effects, I do not find any evidence that the total value of the CEO's portfolio of company stocks and options explains his exercise behavior. This result is consistent with the findings of Sautner and Weber (2009) who use survey data to assess the relationship between individual characteristics and option exercise decisions and find no evidence that differences in diversification or risk-aversion can explain the observed differences in exercise behavior.

Furthermore, including the total dollar value of the CEO's portfolio of company stock and options at the beginning of the fiscal year (CEO investment) as an additional control variable in the compensation regressions has no material effect on the estimation results.[41] Table 2.9 presents the results of these regressions. The coefficient estimates for both optimism measures HighForecast (Panel A) and LongHolder (Panel B) remain negative and statistically significant in the regressions pertaining to the CEO's option grants, bonus payments, and total compensation. In fact, even the magnitudes of the

[41] The total value of a CEO's investment is calculated as the total value of all unvested and vested stock options and all restricted and unrestricted shares that the CEO owns.

point estimates remain similar after adding the additional control variable.

Regarding the use of hedging instruments, Gao (2010) provides evidence that CEOs who face lower hedging costs receive higher-powered incentive contracts. Thus, if holding on longer to exercisable in-the-money options were driven entirely by the better hedging opportunities faced by some CEOs, one would expect a positive association between the optimism measure LongHolder and the CEOs' incentive compensation. I, however, document a negative association. Moreover, according to the firms' SEC filings, such hedging transactions are very rare.[42]

Finally, to further examine whether or not the CEOs that I classify as optimistic are simply more risk-tolerant than their peers, I examine the relationship between the utilized measures of optimism and the percentage of incentive pay in the CEOs' total compensation. In order to do so, I regress the sum of the CEO's bonus payments and restricted stock and option grants divided by his total compensation on the same set of explanatory variables as before. The results are presented in Table 2.10. The coefficient estimates on the optimism measure HighForecast are negative and significant at the the 1% level (columns 1 and 2). The coefficient estimates for LongHolder are negative, but not statistically significant (columns 3 and 4). These results imply a negative relationship—or at least no relationship—between the measures of CEO optimism and the percentage of incentives in the CEOs' total compensation. Graham, Harvey, and Puri (2010), however, provide evidence that CEOs who are more risk-tolerant are more likely to receive proportionally larger compensation in the form of stocks, options, and bonus payments. Similarly, Grund and Sliwka (2010) find that an employee's risk-tolerance has a positive and substantial impact on the likelihood of receiving performance contingent wages. Thus, the empirical findings in this and other papers suggest that differences in risk-tolerance alone do not explain the results.[43]

[42] See, for example, Bettis, Bizjak, and Lemmon (2001) and Gao (2010).

[43] Additional evidence that the late exercising of in-the-money options captures optimism rather than risk-tolerance is provided, for example, by Malmendier and Tate (2005a, 2008), Malmendier, Tate, and Yan (2011), and Campbell, Gallmeyer, Johnson, Rutherford, and Stanley (2011). Further evidence on the positive association between risk-tolerance and incentive pay is provided by Bellemare and Shearer (2010) and Dohmen and Falk (2011).

## 2.6 Conclusion

In this paper I have investigated the relationship between CEO optimism and CEO compensation. A two period principal-agent model was introduced to study the impact of an agent's optimism, and two channels through which optimistic beliefs affect the optimal compensation contract were highlighted. First, optimistic agents overestimate the value of compensation claims that are contingent on positive outcomes. Second, optimists are more prone to retain previously received incentive claims because they believe the market price that outside investors are willing to pay for these claims to be too low. Whether or not a more optimistic agent accumulates more incentive claims over time than a less optimistic agent however depends on the net-effect of retaining a larger fraction of a smaller amount of contingent claims. In any given period, the total effect of an agent's optimism on the different components of his compensation depends on the relative magnitudes of the overvaluation and accumulation effects. The model implies, however, that the average effect of optimism on incentive as well as on total compensation is strictly negative. Sophisticated principals can thus take advantage of optimistic agents by appropriately adjusting their compensation contracts and paying them less than what an unbiased agent would demand.

Using data on CEO compensation in US firms, I have provided empirical evidence that CEOs whose earnings forecasts and option exercise behavior are indicative of optimistic beliefs indeed receive smaller option grants, fewer bonus payments, and less total compensation than their peers. These results shed some light on the interplay between managerial beliefs and compensation and may ultimately help to reconcile some of the observed heterogeneity in the remuneration of observationally similar individuals. Furthermore, these findings provide some insight into how principals can take advantage of biased agents through adjustments of their compensation contracts.

The psychology literature documents a widespread tendency in all humans to be overly optimistic regarding their abilities and their future. Moreover, a growing literature in economics and finance provides evidence that these biases extend to firms' senior executives and CEOs and have an economically significant effect on corporate decisions, actions, and outcomes. Whether or not firms purposefully choose to hire and promote biased managers, the existence of such biases has implications for the optimal design of organizational structures, compensation and incentive schemes, governance mechanisms, and regulation. This paper has focused on the implications of managerial optimism for the design of compensation contracts. However, many unanswered questions regarding the effects of biases in executives' beliefs and how to optimally adjust organizational and contractual features promise numerous avenues for future research.

## Appendix 2.A: Optimal contract and comparative statics

This appendix shows the derivation of the optimal contract that is presented in Section 2.2. The contract is derived by backward induction.

### Period 2: Subgame in which the project can be improved

Let $\alpha \in [0,1]$ denote the fraction of the agent's original incentive claim that he has sold to an outside investor, and let $\theta$ denote the price that the agent received per unit of his claim. The agent's incentive compatibility constraint at $t = 2$ can then be written as

$$\begin{array}{c} (\widehat{p}+\Delta)\cdot u\left[\alpha\theta+s_1+s_2+(1-\alpha)\,b_1+b_2\right] \\ +\,(1-\widehat{p}-\Delta)\cdot u\left[\alpha\theta+s_1+s_2\right]-c_1-c_2 \end{array} \geq \begin{array}{c} \widehat{p}\cdot u\left[\alpha\theta+s_1+s_2+(1-\alpha)\,b_1+b_2\right] \\ +\,(1-\widehat{p})\cdot u\left[\alpha\theta+s_1+s_2\right]-c_1 \end{array}$$

which simplifies to

$$\Delta\cdot\left\{u\left[\alpha\theta+s_1+s_2+(1-\alpha)\,b_1+b_2\right]-u\left[\alpha\theta+s_1+s_2\right]\right\}\geq c_2.$$

That is, the agent prefers to improve the project if the expected gain from doing so is at least as large as the private costs.

The agent's individual rationality constraint is

$$\begin{array}{c} (\widehat{p}+\Delta)\cdot u\left[\alpha\theta+s_1+s_2+(1-\alpha)\,b_1+b_2\right] \\ +\,(1-\widehat{p}-\Delta)\cdot u\left[\alpha\theta+s_1+s_2\right]-c_1-c_2 \end{array} \geq \begin{array}{c} \widehat{p}\cdot u\left[\alpha\theta+s_1+(1-\alpha)\,b_1\right] \\ +\,(1-\widehat{p})\cdot u\left[\alpha\theta+s_1\right]+\Omega_2-c_1. \end{array}$$

The agent prefers to accept the contract offered by the principal and thereafter improve the project if his expected utility from doing so is at least as large as his expected utility in case he declines the principal's offer. Note that if the agent declines the new contract, he does not loose any claims that are already in his possession.

Because the principal is assumed to have all the bargaining power, the agent's participation constraint will be binding when evaluated at the optimal contract. Furthermore, the agent's incentive compatibility constraint will hold with equality at the optimum if the agent has unbiased beliefs.[44] In that case, both parties agree on the probability that the project succeeds, but because the agent is risk-averse, the risk-neutral principal will only expose the agent to the minimum amount of risk that is necessary to induce the agent to improve the project. If the agent is optimistic and disagrees with the principal on the probability of success, the incentive compatibility constraint will be binding as

[44] Both results follow from the first-order conditions of the principal's profit maximization problem.

long as the agent's optimism does not entirely undo the effects of his risk-aversion. More formally, the agent's incentive compatibility constraint will be binding at the optimum if the following assumption is satisfied:

***Assumption 1***

*An agent's optimism does not entirely undo the effects of his risk-aversion at $t = 2$, i.e.,*

$$\frac{u'\left[\alpha^*\theta + s_1^* + s_2^* + (1-\alpha^*)\, b_1^* + b_2^*\right]}{u'\left[\alpha^*\theta + s_1^* + s_2^*\right]} < \frac{(p+\Delta)\,(1-\widehat{p}-\Delta)}{(\widehat{p}+\Delta)\,(1-p-\Delta)}$$

In what follows, I will assume that Assumption 1 is satisfied. That is, I will restrict attention to situations in which both the agent's participation and incentive compatibility constraint are binding at the optimum. In that case, we have

$$u\left[\alpha\theta + s_1 + s_2^* + (1-\alpha)\, b_1 + b_2^*\right] - u\left[\alpha\theta + s_1 + s_2^*\right] = \frac{c_2}{\Delta}$$

and

$$\begin{array}{l} u\left[\alpha\theta + s_1 + s_2\right] - c_1 - c_2 \\ +\,(\widehat{p}+\Delta)\left(\begin{array}{l} u\left[\alpha\theta + s_1 + s_2^* + (1-\alpha)\, b_1 + b_2^*\right] \\ -u\left[\alpha\theta + s_1 + s_2^*\right] \end{array}\right) \end{array} = \begin{array}{l} \widehat{p}\cdot u\left[\alpha\theta + s_1 + (1-\alpha)\, b_1\right] \\ +\,(1-\widehat{p})\cdot u\left[\alpha\theta + s_1\right] + \Omega_2 - c_1. \end{array}$$

Solving for $s_2^*$ and $b_2^*$, we obtain

$$s_2^* = u^{-1}\left\{\widehat{p}\cdot u\left[\alpha\theta + s_1 + (1-\alpha)\, b_1\right] + (1-\widehat{p})\cdot u\left[\alpha\theta + s_1\right] + \Omega_2 - \widehat{p}\frac{c_2}{\Delta}\right\} - a\theta - s_1$$

and

$$\begin{aligned} b_2^* \;=\; & u^{-1}\left\{\widehat{p}\cdot u\left[\alpha\theta + s_1 + (1-\alpha)\, b_1\right] + (1-\widehat{p})\cdot u\left[\alpha\theta + s_1\right] + \Omega_2 + (1-\widehat{p})\,\frac{c_2}{\Delta}\right\} \\ & -u^{-1}\left\{\widehat{p}\cdot u\left[\alpha\theta + s_1 + (1-\alpha)\, b_1\right] + (1-\widehat{p})\cdot u\left[\alpha\theta + s_1\right] + \Omega_2 - \widehat{p}\frac{c_2}{\Delta}\right\} \\ & -(1-\alpha)\, b_1. \end{aligned}$$

Finally, because the individual rationality constraint is binding at the optimum, the agent's expected utility in case the project can be improved is

$$U^1 \equiv \widehat{p}\cdot u\left[\alpha\theta + s_1 + (1-\alpha)\, b_1\right] + (1-\widehat{p})\cdot u\left[\alpha\theta + s_1\right] + \Omega_2 - c_1.$$

### Period 2: Subgame in which the project cannot be improved

If the project cannot be improved, there is no need for the principal to offer any new compensation claims to the agent, i.e., $s_2^* = b_2^* = 0$. In that case, the agent's expected utility is the same as if the agent had declined the principal's offer, that is

$$U^0 \equiv \widehat{p} \cdot u\left[\alpha\theta + s_1 + (1-\alpha)\, b_1\right] + (1-\widehat{p}) \cdot u\left[\alpha\theta + s_1\right] + \Omega_2 - c_1.$$

### The agent's choice of $\alpha$

After the agent has implemented the project, his expected utility is

$$\delta \cdot U^1 + (1-\delta) \cdot U^0 = \widehat{p} \cdot u\left[\alpha\theta + s_1 + (1-\alpha)\, b_1\right] + (1-\widehat{p}) \cdot u\left[\alpha\theta + s_1\right] + \Omega_2 - c_1.$$

Thus, when deciding how much of his original incentive claim to sell to the outside investor, the agent chooses the fraction $\alpha$ that maximizes his expected utility:

$$U^* \equiv \max_{\alpha \in [0,1]} \left\{\widehat{p} \cdot u\left[\alpha\theta + s_1 + (1-\alpha)\, b_1\right] + (1-\widehat{p}) \cdot u\left[\alpha\theta + s_1\right] + \Omega_2 - c_1\right\}.$$

The first order condition to the agent's problem is:[45]

$$\widehat{p} \cdot u'\left[\alpha^*\theta + s_1 + (1-\alpha^*)\, b_1\right] \cdot (\theta - b_1) + (1-\widehat{p}) \cdot u'\left[\alpha^*\theta + s_1\right] \cdot \theta = 0.$$

Risk-neutral, competitive outside investors with unbiased beliefs will offer a price

$$\theta = (p + \delta\Delta)\, b_1,$$

so that the agent's first order condition can be re-written as

$$b_1 \left\{(1-\widehat{p}) \cdot (p+\delta\Delta) \cdot u'\left[\alpha^*\theta + s_1\right] - \widehat{p} \cdot (1 - p - \delta\Delta) \cdot u'\left[\alpha^*\theta + s_1 + (1-\alpha^*)\, b_1\right]\right\} = 0.$$

For $b_1 > 0$ this implies

$$\frac{u'\left[\alpha^*\theta + s_1\right]}{u'\left[\alpha^*\theta + s_1 + (1-\alpha^*)\, b_1\right]} = \frac{\widehat{p} \cdot (1 - p - \delta\Delta)}{(1-\widehat{p}) \cdot (p+\delta\Delta)}.$$

[45] Note that the second order condition

$$\widehat{p} \cdot u''\left[\alpha^*\theta + s_1 + (1-\alpha^*)\, b_1\right] \cdot (\theta - b_1)^2 + (1-\widehat{p}) \cdot u''\left[\alpha^*\theta + s_1\right] \cdot \theta^2 < 0$$

for a maximum is satisfied as well because $u(w)$ is assumed to be concave.

Denoting the left-hand-side of this equation by $g(\alpha^*)$ and the right-hand-side by $h(\widehat{p})$, we have

$$\begin{aligned}
\frac{\partial g(\alpha^*)}{\partial \alpha^*} &= \frac{u''[\alpha^*\theta + s_1] \cdot u'[\alpha^*\theta + s_1 + (1-\alpha^*) b_1] \cdot \theta}{(u'[\alpha^*\theta + s_1 + (1-\alpha^*) b_1])^2} \\
&\quad + \frac{u''[\alpha^*\theta + s_1 + (1-\alpha^*) b_1] \cdot (b_1 - \theta) \cdot u'[\alpha^*\theta + s_1]}{(u'[\alpha^*\theta + s_1 + (1-\alpha^*) b_1])^2} \\
&< 0 \\
\overline{g} &\equiv g(0) = \frac{u'(s_1)}{u'(s_1 + b_1)} > 1 \\
\underline{g} &\equiv g(1) = \frac{u'(\theta + s_1)}{u'(\theta + s_1)} = 1
\end{aligned}$$

That is, $g(\alpha^*)$ is decreasing in $\alpha^*$ with a maximum value of $\overline{g}$ at $\alpha^* = 0$ and a minimum value of 1 at $\alpha^* = 1$.

For $h(\widehat{p})$ we obtain

$$\frac{\partial h(\widehat{p})}{\partial \widehat{p}} = \frac{1}{(1-\widehat{p})^2} \cdot \frac{1 - p - \delta\Delta}{p + \delta\Delta} > 0$$

and

$$h(p + \delta\Delta) = 1,$$

i.e., $h(\widehat{p})$ is increasing in $\widehat{p}$ with $h(\widehat{p}) \leq 1$ for $\widehat{p} \leq p + \delta\Delta$ and $h(\widehat{p}) > 1$ for $\widehat{p} > p + \delta\Delta$.

Regarding the optimal choice of $\alpha$ we therefore have $\alpha^* = 1$ for $\widehat{p} \leq p + \delta\Delta$ and $\alpha^* < 1$ for $\widehat{p} > p + \delta\Delta$. If the agent is not very optimistic about the project ($\widehat{p} \leq p + \delta\Delta$), he always chooses to sell all of his original incentive claim to the outside investor. Otherwise, the agent sells only a fraction of his original incentive claim ($\alpha^* < 1$). In that case, the optimal fraction to sell is determined by the trade-off between the perceived loss from selling the claim at a price the agent deems too low and the utility cost of holding on to a risky claim.

Referring back to the optimal claims granted to the agent in case the project can be improved in the second period, note that we can now express both $s_2^*$ and $b_2^*$ as

$$s_2^* = u^{-1}\left\{U^* + c_1 - \widehat{p}\frac{c_2}{\Delta}\right\} - \alpha^*\theta - s_1$$

and

$$b_2^* = u^{-1}\left\{U^* + c_1 + (1-\widehat{p})\frac{c_2}{\Delta}\right\} - u^{-1}\left\{U^* + c_1 - \widehat{p}\frac{c_2}{\Delta}\right\} - (1-\alpha^*) b_1.$$

## Period 1

Just before the first period, the principal can offer the agent a fixed salary $s_1$ and an incentive claim that pays out $b_1$ in case the project succeeds. Because the agent can sell this incentive claim to an outside investor after the project has been implemented, he can in fact turn the incentive claim into a safe payment. Thus there is no benefit from insuring the agent with a fixed salary, as any fixed payment can be equally provided to the agent by increasing his incentive claim by an amount which will fetch a price equal to the fixed payment when sold to the outside investor. From here on, I will therefore assume that the principal sets $s_1^* = 0$.[46] Thus, the agent's expected utility from implementing the project simplifies to

$$U^* \equiv \max_{\alpha \in [0,1]} \left\{ \widehat{p} \cdot u \left[ \alpha\theta + (1-\alpha)\, b_1 \right] + (1-\widehat{p}) \cdot u \left[ \alpha\theta \right] + \Omega_2 - c_1 \right\}.$$

The agent's individual rationality constraint at $t = 1$ can be written as

$$U^* \left( \alpha^*, \widehat{p}, b_1 \right) \geq \Omega_1 + \Omega_2,$$

and his incentive compatibility constraint as

$$U^* \left( \alpha^*, \widehat{p}, b_1 \right) \geq u \left[ s_1 \right] + \Omega_2.$$

Under the assumption that $u \left[ s_1^* = 0 \right] \leq \Omega_1$, the incentive compatibility constraint is always satisfied as long as the agent's individual rationality constraint holds.

As before, the agent's individual rationality constraint must be binding at the optimum because the principal has all the bargaining power. We thus obtain

$$U^* \left( \alpha^*, \widehat{p}, b_1^* \right) = \Omega_1 + \Omega_2.$$

That is, the agent's expected utility from accepting the principal's offer, taking into account the future optimal choice of $\alpha^*$, must be equal to the utility the agent could derive from his outside options.[47] This in turn implies that for $s_2^*$ and $b_2^*$ we have

$$s_2^* = u^{-1} \left\{ \Omega_1 + \Omega_2 + c_1 - \widehat{p} \frac{c_2}{\Delta} \right\} - \alpha^* \left( p + \delta\Delta \right) b_1^*$$

[46] Note that $s_1^* = 0$ implies $\alpha^* \in (0,1)$ for $\widehat{p} > p + \delta\Delta$ because $\lim_{w \to 0} u'(w) = \infty$. That is, the agent never keeps all of his incentive claim ($\alpha^* = 0$) and always sells some of it to the outside investor.

[47] Note that the agent foresees what price the outside investors will be willing to pay for his original incentive claim as well as his optimal response $\alpha^*$.

and

$$b_2^* = u^{-1}\left\{\Omega_1 + \Omega_2 + c_1 + (1-\widehat{p})\frac{c_2}{\Delta}\right\} - u^{-1}\left\{\Omega_1 + \Omega_2 + c_1 - \widehat{p}\frac{c_2}{\Delta}\right\} - (1-\alpha^*)\, b_1^*$$

in case the project can be improved at $t = 2$. Otherwise, we have $s_2^* = b_2^* = 0$.

Regarding the optimal incentive claim granted to the agent at the beginning of the first period, the principal chooses $b_1^*$ so that

$$U^*(\alpha^*, \widehat{p}, b_1^*) = \Omega_1 + \Omega_2$$

with

$$\alpha^* \in \arg\max_{\alpha\in[0,1]} \left\{\widehat{p}\cdot u\left[\alpha\theta + (1-\alpha)\, b_1^*\right] + (1-\widehat{p})\cdot u\left[\alpha\theta\right] + \Omega_2 - c_1\right\}.$$

Thus, $b_1^*$ is determined by simultaneously satisfying the two equations

$$F(\alpha^*, b_1^*, \widehat{p}) = \frac{u'\left[\alpha^*\theta\right]}{u'\left[\alpha^*\theta + (1-\alpha^*)\, b_1^*\right]} - \frac{\widehat{p}\cdot(1-p-\delta\Delta)}{(1-\widehat{p})\cdot(p+\delta\Delta)} = 0$$

and

$$G(\alpha^*, b_1^*, \widehat{p}) = \widehat{p}\cdot u\left[\alpha^*\theta + (1-\alpha^*)\, b_1^*\right] + (1-\widehat{p})\cdot u\left[\alpha^*\theta\right] - \Omega_1 - c_1 = 0.$$

As we have seen before, $\widehat{p} \leq p + \delta\Delta$ implies $\alpha^* = 1$, and in that case we obtain

$$b_1^* = \frac{u^{-1}\left\{\Omega_1 + c_1\right\}}{p+\delta\Delta}$$

with

$$\frac{db_1^*}{d\widehat{p}} = \frac{d\alpha^*}{d\widehat{p}} = 0.$$

That is, as long as the agent is not very optimistic ($\widehat{p} \leq p + \delta\Delta$), neither the optimal incentive claim granted to the agent at the beginning nor the fraction of incentives that the agent sells to the outside investor depend on $\widehat{p}$.

On the other hand, for $\widehat{p} > p + \delta\Delta$ we have $\alpha^* \in (0, 1)$, i.e., the agent optimally retains a fraction of his original incentive claim. In that case, we have[48]

$$\frac{db_1^*}{d\widehat{p}} = \frac{\frac{\partial G}{\partial\alpha^*}\cdot\frac{\partial F}{\partial\widehat{p}} - \frac{\partial G}{\partial\widehat{p}}\cdot\frac{\partial F}{\partial\alpha^*}}{\frac{\partial G}{\partial b_1^*}\cdot\frac{\partial F}{\partial\alpha^*} - \frac{\partial G}{\partial\alpha^*}\cdot\frac{\partial F}{\partial b_1^*}}$$

and

$$\frac{d\alpha^*}{d\widehat{p}} = \frac{\frac{\partial G}{\partial b_1^*}\cdot\frac{\partial F}{\partial\widehat{p}} - \frac{\partial G}{\partial\widehat{p}}\cdot\frac{\partial F}{\partial b_1^*}}{\frac{\partial G}{\partial\alpha^*}\cdot\frac{\partial F}{\partial b_1^*} - \frac{\partial G}{\partial b_1^*}\cdot\frac{\partial F}{\partial\alpha^*}}.$$

48 Both expressions can be derived from the total derivatives of $F(\alpha^*, b_1^*, \widehat{p})$ and $G(\alpha^*, b_1^*, \widehat{p})$.

Taking partial derivatives of $F$ and $G$ with respect to $\alpha^*$, $b_1^*$, and $\widehat{p}$ we obtain after some simplifying algebra

$$\begin{aligned}
\frac{\partial F}{\partial \alpha^*} &= \frac{u''[\alpha^*\theta](p+\delta\Delta)\, b_1^* u'[\alpha^*\theta+(1-\alpha^*)\, b_1^*]}{(u'[\alpha^*\theta+(1-\alpha^*)\, b_1^*])^2} \\
&\quad + \frac{u''[\alpha^*\theta+(1-\alpha^*)\, b_1^*]\, b_1^*(1-p-\delta\Delta)\, u'[\alpha^*\theta]}{(u'[\alpha^*\theta+(1-\alpha^*)\, b_1^*])^2} \\
\frac{\partial F}{\partial b_1^*} &= 0 \\
\frac{\partial F}{\partial \widehat{p}} &= -\frac{1-p-\delta\Delta}{(1-\widehat{p})^2\cdot(p+\delta\Delta)} \\
\frac{\partial G}{\partial \alpha^*} &= 0 \\
\frac{\partial G}{\partial b_1^*} &= \widehat{p}\cdot u'[\alpha^*\theta+(1-\alpha^*)\, b_1^*] \\
\frac{\partial G}{\partial \widehat{p}} &= u[\alpha^*\theta+(1-\alpha^*)\, b_1] - u[\alpha^*\theta]
\end{aligned}$$

and therefore

$$\frac{db_1^*}{d\widehat{p}} = -\frac{u[\alpha^*\theta+(1-\alpha^*)\, b_1^*] - u[\alpha^*\theta]}{\widehat{p}u'[\alpha^*\theta+(1-\alpha^*)\, b_1^*]} < 0$$

and

$$\frac{d\alpha^*}{d\widehat{p}} = -\frac{\alpha^*[1-\alpha^*(1-p-\delta\Delta)]}{\widehat{p}(1-\widehat{p})\gamma} < 0.$$

That is, if the agent is sufficiently optimistic to retain a fraction of his original incentive claim, both the optimal initial incentive claim as well as the fraction of incentives that the agent chooses to sell after implementing the project are decreasing in the agent's optimism.

### Comparative statics for $s_2^*$ and $b_2^*$

Taking derivatives of $s_2^*$ and $b_2^*$ with respect to $\widehat{p}$, we obtain for $\widehat{p} \leq p+\delta\Delta$

$$\frac{ds_2^*}{d\widehat{p}} = -\frac{\frac{c_2}{\Delta}}{u'\left[u^{-1}\left\{\Omega_1+\Omega_2-c_1-\widehat{p}\frac{c_2}{\Delta}\right\}\right]} < 0$$

and

$$\frac{db_2^*}{d\widehat{p}} = -\frac{\frac{c_2}{\Delta}}{u'\left[u^{-1}\left\{\Omega_1+\Omega_2+c_1+(1-\widehat{p})\frac{c_2}{\Delta}\right\}\right]} + \frac{\frac{c_2}{\Delta}}{u'\left[u^{-1}\left\{\Omega_1+\Omega_2+c_1-\widehat{p}\frac{c_2}{\Delta}\right\}\right]} < 0.$$

For $\widehat{p} > p+\delta\Delta$ we have

$$\frac{ds_2^*}{d\widehat{p}} = \underbrace{-\frac{\frac{c_2}{\Delta}}{u'\left[u^{-1}\left\{\Omega_1+\Omega_2+c_1-\widehat{p}\frac{c_2}{\Delta}\right\}\right]}}_{(-)}\underbrace{-(p+\delta\Delta)\,\alpha^*\frac{db_1^*}{d\widehat{p}}}_{(+)}\underbrace{-(p+\delta\Delta)\frac{da^*}{d\widehat{p}}b_1^*}_{(+)}$$

and

$$\frac{db_2^*}{d\widehat{p}} = \underbrace{-\frac{\frac{c_2}{\Delta}}{u'\left[u^{-1}\left\{\Omega_1+\Omega_2+c_1+(1-\widehat{p})\frac{c_2}{\Delta}\right\}\right]}+\frac{\frac{c_2}{\Delta}}{u'\left[u^{-1}\left\{\Omega_1+\Omega_2+c_1-\widehat{p}\frac{c_2}{\Delta}\right\}\right]}}_{(-)}$$
$$\underbrace{-(1-\alpha^*)\frac{db_1^*}{d\widehat{p}}}_{(+)}\underbrace{+\frac{da^*}{d\widehat{p}}b_1^*}_{(-)}.$$

**Probability weighted average effects of optimism: $\Upsilon$ and $\Psi$**

Define the probability weighted average effect of an agent's optimism on his incentive compensation as

$$\Upsilon \equiv \frac{1}{1+\delta}\cdot\frac{db_1^*}{d\widehat{p}}+\frac{\delta}{1+\delta}\cdot\frac{db_2^*}{d\widehat{p}},$$

and the probability weighted average effect on his total compensation as

$$\Psi \equiv \frac{1}{1+\delta}\cdot\left(\frac{db_1^*}{d\widehat{p}}+\frac{ds_1^*}{d\widehat{p}}\right)+\frac{\delta}{1+\delta}\cdot\left(\frac{db_2^*}{d\widehat{p}}+\frac{ds_2^*}{d\widehat{p}}\right).$$

Note that the effect of an agent's optimism in the first period is observed with certainty, whereas the effect in the second period is only observed if the project can be improved.

Regarding $\Upsilon$, we obtain for $\widehat{p}\leq p+\delta\Delta$, i.e., for agents that are not very optimistic and that sell their entire incentive claim to the outside investor,

$$\begin{aligned}\Upsilon &= \frac{\delta}{1+\delta}\left(-\frac{\frac{c_2}{\Delta}}{u'\left[u^{-1}\left\{\Omega_1+\Omega_2+c_1+(1-\widehat{p})\frac{c_2}{\Delta}\right\}\right]}+\frac{\frac{c_2}{\Delta}}{u'\left[u^{-1}\left\{\Omega_1+\Omega_2+c_1-\widehat{p}\frac{c_2}{\Delta}\right\}\right]}\right)\\ &< 0.\end{aligned}$$

For $\widehat{p}>p+\delta\Delta$, i.e., for agents that are sufficiently optimistic to retain a fraction of their incentive claim, we have

$$\begin{aligned}\Upsilon &= \frac{\delta}{1+\delta}\left(-\frac{\frac{c_2}{\Delta}}{u'\left[u^{-1}\left\{\Omega_1+\Omega_2+c_1+(1-\widehat{p})\frac{c_2}{\Delta}\right\}\right]}+\frac{\frac{c_2}{\Delta}}{u'\left[u^{-1}\left\{\Omega_1+\Omega_2+c_1-\widehat{p}\frac{c_2}{\Delta}\right\}\right]}\right)\\ &\quad+\frac{\delta}{1+\delta}\cdot\frac{da^*}{d\widehat{p}}b_1^*+\frac{1}{1+\delta}\cdot\frac{db_1^*}{d\widehat{p}}\left[1-\delta(1-\alpha^*)\right]\\ &< 0.\end{aligned}$$

For $\Psi$ we obtain in case of $\widehat{p}\leq p+\delta\Delta$

$$\begin{aligned}\Psi &= \frac{\delta}{1+\delta}\left(-\frac{\frac{c_2}{\Delta}}{u'\left[u^{-1}\left\{\Omega_1+\Omega_2+c_1+(1-\widehat{p})\frac{c_2}{\Delta}\right\}\right]}\right)\\ &< 0,\end{aligned}$$

and for $\widehat{p} > p + \delta\Delta$, we have

$$\begin{aligned}\Psi &= \frac{\delta}{1+\delta}\left(-\frac{\frac{c_2}{\Delta}}{u'\left[u^{-1}\left\{\Omega_1+\Omega_2+c_1+(1-\widehat{p})\frac{c_2}{\Delta}\right\}\right]}+\frac{da^*}{d\widehat{p}}b_1^*\left(1-p-\delta\Delta\right)\right)\\ &\quad +\frac{1}{1+\delta}\cdot\frac{db_1^*}{d\widehat{p}}\left\{1-\delta\left[1-\alpha^*\left(1-p-\delta\Delta\right)\right]\right\}\\ &< 0.\end{aligned}$$

## Appendix 2.B: Description of cleanse indicators

As mentioned in Section 2.3, the insider filings data obtained from Thomson Reuters contain cleanse indicators that indicate the overall level of confidence in each record. The following information regarding these indicators is taken from the data description file that is provided by Thomson Reuters together with the data. Thomson's proprietary data cleansing process verifies the accuracy and reasonableness of insider reported figures by reference to external sources. Data (e.g., transaction prices, acquisition/disposition indicators, etc.) that appear erroneous or unreasonable are corrected by substituting information from alternative sources. The cleanse indicator indicates Thomson's level of confidence concerning the accuracy of a particular record contained in the database. There are nine cleanse indicators:

- R: Data verified through the cleansing process
- H: Cleansed with a very high level of confidence
- L: One or more data cleansing actions were undertaken but secondary sources were unavailable for complete verification
- I: Some data elements were improved (inserted or replaced) in order to make the data usable. In some cases, records with a cleanse indicator of "I" may contain data that could not be verified or were determined to be outside of a reasonable range
- C: A record added to nonderivative table or derivative table in order to correspond with a record on the opposing table
- W: Indicates an improperly reported holding record on the derivative table. This occurs when the insider reports a holdings value in the number of derivatives or number of underlying shares field (and no value was reported for resulting derivatives held)
- Y: An as-reported holding value identified by data cleansing
- S: No cleansing attempted; security does not meet our collection requirements
- A: Numerous data elements were missing or invalid; reasonable assumptions could not be made

## Appendix 2.C: Pay reduction versus value destruction

In Section 2.2, I have assumed that the principal always wants the agent to implement and thereafter improve the project—there was no "bad" project. Thus, an optimistic agent could not do any damage by implementing an unwanted project. In this extension, I drop this assumption and examine the trade-off between the reduction in compensation due to an agent's optimism on the one hand and the potential value destruction due to sub-optimal implementation decisions on the other hand.

Instead of focussing on a single "good" project as in Section 2.2, I consider a project that can be either "good" or "bad". The principal would like the agent to implement the project only if it is good, but not if it is bad. However, the project's type is unknown ex-ante and can be learned only by the agent after he has accepted any contract offered by the principal. Note that it is a crucial assumption that the type of the project is not observable by anybody but the agent and by him only after the contracting stage. Otherwise, the principal can typically design a contract that induces the agent to implement only the good, but never the bad project. If this is feasible, the agent's only choice is whether or not to implement the good project, and the situation resembles the original setting outlined in Section 2.2.

To be specific, I assume that instead of the project described in Section 2.2, the firm has a one-period project which is either good with probability $\phi$ or bad with probability $(1-\phi)$. In either case, the direct cost of implementing the project is $I$. The project's payoff at $t=1$ is $Q$ if it is successful and 0 otherwise. This payoff is the only verifiable information, so any compensation claim offered to the agent will be either a fixed claim that is independent of the project's outcome or a variable claim that pays off only in case the project succeeds. A good project succeeds with probability $p_g$ and a bad project with probability $p_b$. In addition to the cost $I$, which is borne by the firm directly, implementing the project entails private effort costs $c_g$ if the project is good and $c_b$ if it is bad. The timing of events and decisions is as follows. First, the principal offers a compensation contract to the agent. If the agent accepts the contract, he learns the type of the project and then decides whether or not to implement the project. At $t=1$, the project's payoff is realized and all compensation claims are paid.

Concerning preferences and beliefs, I assume as before that the principal is risk-neutral with utility function $V(\pi)=\pi$, where $\pi$ denotes the principal's final net payoff.

The agent is risk-averse with utility function $U(w, c) = u(w) - c$, where $w$ denotes the agent's wealth at the end of the period, and $c$ denotes the agent's effort costs. $u(w)$ satisfies $u'(w) > 0$ and $u''(w) < 0$. The agent has zero wealth at the beginning and access to some outside option that provides utility $\Omega$. The discount rate is normalized to zero. Both the agent and the principal know $\phi$, $I$, $c_g$, $c_b$, and $Q$. While the principal and an unbiased agent believe the probabilities of success to be $p_g$ and $p_b$, an optimistic agent believes in $\widehat{p}_g > p_g$ and $\widehat{p}_b > p_b$. However, as in Section 2.2, I assume that the agent's optimism is not so extreme as to entirely undo the agent's risk-aversion.[49] Furthermore, I assume that the principal wants the agent to implement the good, but not the bad project,[50] and that the private effort costs and (perceived) probabilities of success satisfy

$$\frac{c_b}{p_b} > \frac{c_g}{p_g} > \frac{c_g}{\widehat{p}_g} > \frac{c_b}{\widehat{p}_b}.$$

Under this assumption, the principal will be able to design a contract that induces an unbiased agent to implement the project only if it is good. An optimistic agent on the other hand, will always implement both projects or neither. Note that it is crucial that under the optimal contract the actions taken by the unbiased agent differ from those taken by the optimist. If the principal can design a contract such that both types of agents take the same actions, an optimistic agent never does more damage than an unbiased agent and there is no trade-off between the reduction in the agent's compensation and the reduction in firm value due to sub-optimal decisions.

### Optimal contract for an unbiased agent

Consider first an agent with unbiased beliefs. The principal's task is to induce the agent to implement the good, but not the bad project. Denoting the agent's fixed compensation with $f$ and his variable compensation with $v$, the agent's incentive compatibility constraints can be written as

$$p_g \cdot u[f + v] + (1 - p_g) \cdot u[f] - c_g \geq u[f]$$

[49] Formally, I assume that

$$\frac{u'\left[\widehat{f}^* + \widehat{v}^*\right]}{u'\left[\widehat{f}^*\right]} < \frac{q \cdot (1 - \widehat{q})}{\widehat{q} \cdot (1 - q)},$$

with $q \equiv \phi p_g + (1 - \phi) p_b$, $\widehat{q} \equiv \phi \widehat{p}_g + (1 - \phi) \widehat{p}_b$, and $\widehat{f}^*$ denoting the agent's fixed and $\widehat{v}^*$ his variable compensation.

[50] This assumption is satisfied for $p_g \cdot Q - I - w^* > 0 > p_b \cdot Q - I$, where $w^*$ denotes the expected cost of compensating the agent.

and

$$p_b \cdot u[f+v] + (1-p_b)\, u[f] - c_b < u[f].$$

That is, the agent will choose to implement the good but not the bad project as long as

$$\frac{c_b}{p_b} > u[f+v] - u[f] \geq \frac{c_g}{p_g}.$$

The agent's individual rationality constraint is

$$\phi \cdot \{p_g \cdot u[f+v] + (1-p_g) \cdot u[f] - c_g\} + (1-\phi) \cdot u[f] \geq \Omega.$$

Evaluated at the optimal contract, the agent's individual rationality constraint and incentive compatibility constraint with respect to implementing the good project will both be binding if the agent is unbiased and the principal has all the bargaining power. Thus, we have

$$u[f^* + v^*] - u[f^*] = \frac{c_g}{p_g}$$

and

$$u[f^*] + \phi \cdot \{p_g \cdot (u[f^* + v^*] - u[f^*]) - c_g\} = \Omega.$$

Solving for $f^*$ and $v^*$ we obtain

$$f^* = u^{-1}\{\Omega\}$$

and

$$v^* = u^{-1}\left\{\Omega + \frac{c_g}{p_g}\right\} - u^{-1}\{\Omega\}.$$

### Optimal contract for an optimistic agent

Consider now an optimistic agent. In order to ensure that the agent will accept the contract and implement the project if it is good, the principal must set the agent's compensation so that

$$\begin{array}{c} \phi \cdot \left\{\widehat{p}_g \cdot u\left[\widehat{f} + \widehat{v}\right] + (1-\widehat{p}_g) \cdot u\left[\widehat{f}\right] - c_g\right\} \\ + (1-\phi) \cdot \left\{\widehat{p}_b \cdot u\left[\widehat{f} + \widehat{v}\right] + (1-\widehat{p}_b) \cdot u\left[\widehat{f}\right] - c_b\right\} \end{array} \geq \Omega.$$

and

$$u\left[\widehat{f} + \widehat{v}\right] - u\left[\widehat{f}\right] \geq \frac{c_g}{\widehat{p}_g} > \frac{c_b}{\widehat{p}_b}.$$

As for the unbiased agent, both constraints will be binding at the optimum, and we obtain

$$\widehat{f^*} = u^{-1}\left\{\Omega - (1-\phi) \cdot \left(\frac{\widehat{p}_b}{\widehat{p}_g} c_g - c_b\right)\right\}$$

and

$$\widehat{v}^* = u^{-1}\left\{\Omega - (1-\phi)\cdot\left(\frac{\widehat{p}_b}{\widehat{p}_g}c_g - c_b\right) + \frac{c_g}{\widehat{p}_g}\right\} - u^{-1}\left\{\Omega - (1-\phi)\cdot\left(\frac{\widehat{p}_b}{\widehat{p}_g}c_g - c_b\right)\right\}.$$

An optimistic agent thus receives less fixed compensation, $\widehat{f}^* < f^*$, and lower variable compensation, $\widehat{v}^* < v^*$, than an unbiased agent.

### Comparison of ex-ante firm values

The ex-ante value of the firm in case of an unbiased agent is

$$V = \phi\cdot[p_g\cdot Q - I] - f^* - \phi\cdot p_g\cdot v^*,$$

and in case the agent is optimistic, we have

$$\widehat{V} = \phi\cdot[p_g\cdot Q - I] - \widehat{f}^* - \phi\cdot p_g\cdot\widehat{v}^* + (1-\phi)\cdot[p_b\cdot(Q-\widehat{v}^*) - I].$$

Thus, the ex-ante value of the firm is higher for an unbiased than for an optimistic agent if

$$f^* - \widehat{f}^* + \phi\cdot p_g\cdot(v^* - \widehat{v}^*) - (1-\phi)\cdot p_b\cdot\widehat{v}^* < (1-\phi)\cdot[I - p_b\cdot Q],$$

that is, if the expected cost savings from the optimist's reduced compensation are smaller than the expected value destruction caused by implementing a bad project. It follows that the principal prefers an unbiased agent as long as the probability that the project is good satisfies

$$\phi < \phi^* = \frac{I - p_b\cdot(Q-\widehat{v}^*) - f^* + \widehat{f}^*}{I - p_b\cdot(Q-\widehat{v}^*) + p_g\cdot(v^* - \widehat{v}^*)} < 1.$$

Figure 2.1: Model overview

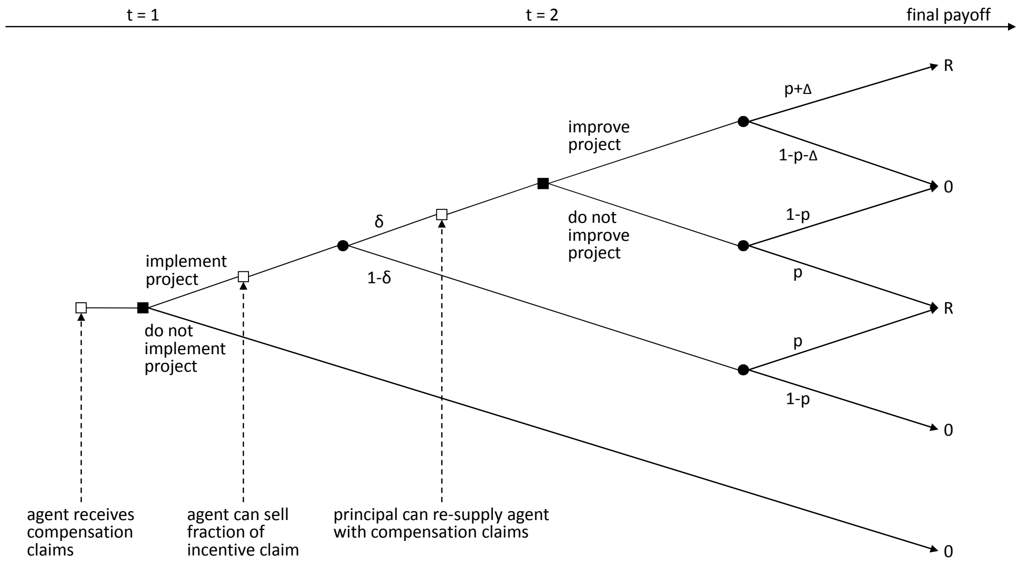


Figure 2.2: Timing of events and decisions

| | **t=1** | | | | **t=2** | |
|---|---|---|---|---|---|---|
| Agent is granted original compensation claims | Agent decides whether or not to implement the project (observable) | Agent decides what fraction of his incentive claim to sell (observable) | Whether or not the project can be improved becomes common knowledge | Principal can re-supply the agent with compensation claims | Agent decides whether or not to improve the project (if feasible) | Project pays off $R$ if successful and 0 otherwise (verifiable) |

Table 2.1: Summary statistics

This table presents summary statistics for the final sample of 11,477 observations. The variables are as follows: *Total Compensation* is the CEO's total compensation (Execucomp item TDC1). *Salary* is the CEO's salary. *Bonus* is the amount of bonus payments. *Restricted Stock* is the dollar value of restricted stock grants. *Options* is the Black-Scholes value of option awards. *Incentives/Total Compensation* is the sum of *Bonus*, *Restricted Stock*, and *Options* divided by *Total Compensation*. *Tenure* is the number of years since the CEO has been appointed. *Age* is the CEO's age during the year of the observation. *Male* is a dummy variable that takes the value 1 if the CEO is male. *LongHolder* is the measure of CEO optimism that is based on the CEOs' option exercise decisions. *HighForecast* is the measure of CEO optimism that is based on the discrepancy between the firms' EPS forecasts and the eventually realized EPS. Compensation variables are reported in USD '000.

Panel A

| Variable | Observations | Mean | Median | Std. Dev. | Min | Max |
|---|---|---|---|---|---|---|
| Total Compensation | 11,477 | 5,664 | 2,914 | 11,938 | 0 | 600,347 |
| Salary | 11,477 | 670 | 619 | 351 | 0 | 5,807 |
| Bonus | 11,477 | 846 | 450 | 1,538 | 0 | 43,512 |
| Restricted Stock | 11,477 | 560 | 0 | 2,284 | 0 | 74,750 |
| Options | 11,477 | 3,087 | 1,042 | 10,654 | 0 | 600,347 |
| Incentives/Total Comp. | 11,477 | 0.65 | 0.71 | 0.24 | 0.00 | 1.00 |

Panel B

| Variable | Observations | Mean | Median | Std. Dev. | Min | Max |
|---|---|---|---|---|---|---|
| Tenure | 11,477 | 7.0 | 5.0 | 6.8 | 0.0 | 52.0 |
| Age | 11,477 | 55.1 | 55.0 | 7.0 | 29.0 | 86.0 |
| Male | 11,477 | 0.98 | 1.00 | 0.12 | 0.00 | 1.00 |
| HighForecast | 10,147 | 0.53 | 0.50 | 0.36 | 0.00 | 1.00 |
| LongHolder | 6,955 | 0.32 | 0.00 | 0.41 | 0.00 | 1.00 |

Panel C

| Forecast observations per CEO-firm combination | | Fraction of CEO-firm combinations | |
|---|---|---|---|
| Mean | 6.7 | | |
| Median | 4.0 | HighForecast $= 0$ | 20% |
| Std. Dev. | 6.5 | HighForecast $\in (0,1)$ | 54% |
| Min | 1.0 | HighForecast $= 1$ | 26% |
| Max | 35.0 | | |

Panel D

| Exercise observations per CEO-firm combination | | Fraction of CEO-firm combinations | |
|---|---|---|---|
| Mean | 8.0 | | |
| Median | 4.0 | LongHolder $= 0$ | 55% |
| Std. Dev. | 13.1 | LongHolder $\in (0,1)$ | 28% |
| Min | 1.0 | LongHolder $= 1$ | 17% |
| Max | 161.0 | | |

Table 2.2: Firm characteristics

This table presents summary statistics for various firm characteristics. In Panel A, CEOs for which *HighForecast* or *LongHolder* is equal to 1 (0) are classified as optimistic (non-optimistic). In Panel B, new CEOs are classified as more (less) optimistic than the old CEO if the value of *HighForecast* or *LongHolder* or is higher (lower) than for the old CEO. All characteristics are measured at the end of the year that precedes the year in which the (new) CEO was appointed. ***, **, and * denote significance at the 1%, 5%, and 10% level, respectively.

Panel A: Firms with non-optimistic or optimistic CEOs

| | CEO is non-optimistic | | CEO is optimistic | | |
|---|---|---|---|---|---|
| | N | Mean (Std.Dev.) | N | Mean (Std.Dev.) | Diff. (Std.Err.) |
| MktCap | 726 | 5,200 | 474 | 6,170 | 970 |
| | | *(15,236)* | | *(26,611)* | *(1,347)* |
| Assets | 809 | 8,715 | 511 | 9,389 | 674 |
| | | *(43,114)* | | *(33,794)* | *(2,129)* |
| Sales | 805 | 3,969 | 511 | 4,527 | 558 |
| | | *(11,630)* | | *(11,081)* | *(639)* |
| Leverage | 804 | 0.19 | 508 | 0.18 | -0.01 |
| | | *(0.20)* | | *(0.18)* | *(0.01)* |
| MtB | 720 | 1.62 | 472 | 1.36 | -0.25*** |
| | | *(1.81)* | | *(1.44)* | *(0.09)* |
| Return | 672 | 0.07 | 427 | 0.06 | -0.01 |
| | | *(0.73)* | | *(0.48)* | *(0.04)* |
| Std.Return | 689 | 0.13 | 441 | 0.11 | -0.02*** |
| | | *(0.07)* | | *(0.05)* | *(0.00)* |
| Cash/Assets | 779 | 0.08 | 478 | 0.07 | -0.01** |
| | | *(0.11)* | | *(0.10)* | *(0.01)* |
| R&D/Assets | 809 | 0.05 | 511 | 0.03 | -0.02*** |
| | | *(0.16)* | | *(0.06)* | *(0.01)* |
| Capex/Assets | 755 | 0.07 | 477 | 0.07 | 0.00 |
| | | *(0.06)* | | *(0.06)* | *(0.00)* |
| EBIT/Assets | 791 | 0.08 | 502 | 0.08 | 0.01 |
| | | *(0.16)* | | *(0.17)* | *(0.01)* |

Panel B: Firms that change their CEO

| | New CEO less optimistic | | New CEO more optimistic | | |
|---|---|---|---|---|---|
| | N | Mean (Std.Dev.) | N | Mean (Std.Dev.) | Diff. (Std.Err.) |
| MktCap | 291 | 14,873 | 133 | 11,776 | -3,096 |
| | | *(40,470)* | | *(30,987)* | *(3,584)* |
| Assets | 291 | 17,162 | 133 | 20,717 | 3,555 |
| | | *(60,147)* | | *(104,817)* | *(9,749)* |
| Sales | 291 | 8,922 | 133 | 7,395 | -1,527 |
| | | *(21,976)* | | *(14,952)* | *(1,828)* |
| Leverage | 288 | 0.19 | 132 | 0.18 | -0.01 |
| | | *(0.14)* | | *(0.16)* | *(0.02)* |
| MtB | 288 | 1.85 | 132 | 1.78 | -0.07 |
| | | *(2.15)* | | *(2.68)* | *(0.27)* |
| Return | 281 | 0.02 | 131 | -0.01 | -0.04 |
| | | *(0.60)* | | *(0.53)* | *(0.06)* |
| Std.Return | 281 | 0.13 | 131 | 0.14 | 0.01* |
| | | *(0.07)* | | *(0.07)* | *(0.01)* |
| Cash/Assets | 284 | 0.08 | 131 | 0.09 | 0.01 |
| | | *(0.10)* | | *(0.12)* | *(0.01)* |
| R&D/Assets | 291 | 0.04 | 133 | 0.03 | -0.01* |
| | | *(0.06)* | | *(0.04)* | *(0.01)* |
| Capex/Assets | 279 | 0.06 | 130 | 0.05 | 0.00 |
| | | *(0.04)* | | *(0.04)* | *(0.00)* |
| EBIT/Assets | 291 | 0.09 | 133 | 0.09 | 0.00 |
| | | *(0.12)* | | *(0.08)* | *(0.01)* |

Table 2.3: Effect of CEO optimism on CEO compensation

This table presents the regression results regarding the effect of CEO optimism on CEO compensation. The dependent variable in all regressions is $Ln\,(y+1)$, where $y$ denotes the compensation variable of interest (in USD '000). *HighForecast* is the optimism measure based on the EPS forecast behavior. *LongHolder* is the optimism measure based on the CEO's option exercise behavior. *Options* is the Black-Scholes value of option awards. *Rst.Stock* is the value of restricted stock grants. *Bonus*, *Salary*, and *Tot.Comp.* are the CEO's bonus payments, salary, and total compensation. *MktCap* is the firm's market capitalization. *Std.Return* is the standard deviation of stock returns during the last 60 months. *Leverage* is the ratio of total long term debt to total assets. *MtB* is the ratio of the sum of the firm's market capitalization and total long term debt to total assets. *Cash/Assets* is the firm's cash holdings scaled by total assets. *R&D/Assets* is the firm's R&D expenditures scaled by total assets. *R&D missing* is a dummy variable for observations for which *R&D/Assets* is set to zero due to missing values. *MktCap*, *Std.Return*, *Leverage*, *MtB*, *Cash/Assets*, and *R&D/Assets* are measured at the end of the fiscal year that precedes the year in which the current CEO was appointed. *Boardsize* is the number of directors on the firm's board, and *Independent* is the percentage of independent directors. *Return* is the firm's stock return over the current fiscal year. *EBIT/Assets* is the firm's EBIT divided by total assets. Heterogeneity robust standard errors that allow for clustering at the CEO-firm level are reported in parentheses. ***, **, and * denote significance at the 1%, 5%, and 10% level, respectively.

Panel A

| | Options | Rst.Stock | Bonus | Salary | Tot.Comp. |
|---|---|---|---|---|---|
| HighForecast | -0.804*** | -0.075 | -0.703*** | -0.122 | -0.231*** |
| | *(0.244)* | *(0.334)* | *(0.226)* | *(0.099)* | *(0.076)* |
| Ln(MktCap) | 0.056 | 0.135 | 0.137 | 0.041 | 0.023 |
| | *(0.095)* | *(0.139)* | *(0.100)* | *(0.030)* | *(0.033)* |
| Std.Return | -2.387 | 6.157 | 5.699* | 1.154 | -1.823* |
| | *(2.944)* | *(4.176)* | *(3.169)* | *(0.855)* | *(0.940)* |
| Leverage | -0.193 | -0.144 | -0.641 | -0.442 | 0.053 |
| | *(0.660)* | *(0.915)* | *(0.655)* | *(0.275)* | *(0.221)* |
| MtB | -0.148** | 0.029 | -0.159** | 0.006 | -0.024 |
| | *(0.067)* | *(0.092)* | *(0.073)* | *(0.017)* | *(0.026)* |
| Cash/Assets | 1.130 | -2.129 | 1.072 | -0.893 | -0.010 |
| | *(1.061)* | *(1.583)* | *(1.030)* | *(0.549)* | *(0.411)* |
| R&D/Assets | 6.684*** | 7.008** | -0.426 | -2.270** | 3.300*** |
| | *(1.862)* | *(3.398)* | *(2.361)* | *(1.138)* | *(0.731)* |
| R&D missing | -0.553 | 0.285 | 0.421 | 0.355 | 0.103 |
| | *(0.396)* | *(0.541)* | *(0.289)* | *(0.221)* | *(0.088)* |
| Boardsize | 0.053* | -0.040 | -0.030 | 0.024 | 0.003 |
| | *(0.032)* | *(0.040)* | *(0.036)* | *(0.018)* | *(0.008)* |
| Independent | 0.669 | 0.191 | 0.081 | 0.286** | -0.080 |
| | *(0.494)* | *(0.524)* | *(0.381)* | *(0.135)* | *(0.127)* |
| Return | -0.018 | 0.121*** | 0.287 | 0.001 | -0.001 |
| | *(0.043)* | *(0.030)* | *(0.210)* | *(0.004)* | *(0.012)* |
| EBIT/Assets | 1.616** | -0.015 | 11.067*** | 0.266 | 1.771*** |
| | *(0.728)* | *(0.729)* | *(1.062)* | *(0.188)* | *(0.282)* |
| Firm, year, tenure, age, and gender dummies | Yes | Yes | Yes | Yes | Yes |
| $R^2$ | 0.431 | 0.515 | 0.497 | 0.758 | 0.723 |
| N | 5,890 | 5,890 | 5,890 | 5,890 | 5,890 |

Panel B

| | Options | Rst.Stock | Bonus | Salary | Tot.Comp. |
|---|---|---|---|---|---|
| LongHolder | -0.824*** | 0.479 | -0.577** | -0.443*** | -0.190** |
| | *(0.315)* | *(0.491)* | *(0.267)* | *(0.144)* | *(0.086)* |
| Ln(MktCap) | 0.055 | 0.294 | 0.049 | 0.140 | 0.059 |
| | *(0.198)* | *(0.277)* | *(0.163)* | *(0.089)* | *(0.052)* |
| Std.Return | 1.156 | 4.969 | 9.848** | 1.766 | -1.654 |
| | *(4.740)* | *(7.705)* | *(4.111)* | *(1.325)* | *(1.283)* |
| Leverage | 0.328 | 0.082 | -1.640* | -0.898** | 0.010 |
| | *(0.899)* | *(1.205)* | *(0.849)* | *(0.391)* | *(0.273)* |
| MtB | -0.059 | -0.104 | 0.033 | 0.003 | -0.043 |
| | *(0.099)* | *(0.145)* | *(0.076)* | *(0.039)* | *(0.033)* |
| Cash/Assets | 0.374 | 2.715 | 0.662 | -0.549 | 0.706 |
| | *(1.399)* | *(1.666)* | *(0.843)* | *(0.343)* | *(0.437)* |
| R&D/Assets | -1.563 | -0.149 | 3.216 | 1.350 | 1.336 |
| | *(4.502)* | *(3.817)* | *(2.555)* | *(1.144)* | *(1.474)* |
| R&D missing | -0.308 | -0.003 | -0.611 | 0.645 | 0.084 |
| | *(0.701)* | *(1.354)* | *(0.472)* | *(0.482)* | *(0.103)* |
| Boardsize | 0.056 | -0.029 | -0.036 | 0.002 | 0.006 |
| | *(0.042)* | *(0.051)* | *(0.037)* | *(0.011)* | *(0.010)* |
| Independent | 0.159 | 0.733 | 0.074 | 0.169 | 0.074 |
| | *(0.625)* | *(0.687)* | *(0.478)* | *(0.112)* | *(0.133)* |
| Return | -0.002 | 0.101*** | 0.201 | -0.003 | 0.003 |
| | *(0.041)* | *(0.025)* | *(0.163)* | *(0.006)* | *(0.011)* |
| EBIT/Assets | 1.743* | 0.540 | 10.946*** | 0.664*** | 1.887*** |
| | *(1.023)* | *(0.862)* | *(1.393)* | *(0.252)* | *(0.312)* |
| Firm, year, tenure, age, and gender dummies | Yes | Yes | Yes | Yes | Yes |
| $R^2$ | 0.476 | 0.564 | 0.505 | 0.688 | 0.775 |
| N | 3,980 | 3,980 | 3,980 | 3,980 | 3,980 |

Table 2.4: Option characteristics for optimistic and non-optimistic CEOs

This table presents descriptive statistics for the options that are granted to CEOs that are optimistic and to CEOs that are not optimistic. CEOs are classified based on the optimism measure *HighForecast* in Panel A and based on *LongHolder* in Panel B. *Ln(Black-Scholes value)* is the natural logarithm of the average Black-Scholes value of option grants (in USD '000). *Number of options per grant* is the average number of options per grant (in '000). *Maturity of granted options* is the average difference in years between the year in which the options were granted and the year in which they expire. *Moneyness at grant date* is the average difference between the share price on the grant date and the exercise price divided by the exercise price. *Exercise window* is the average number of years between the options' vesting and expiration dates. *Waited until exercised* is the average number of years the CEO waited until exercising after the options' vesting date. The unit of observation is a CEO-firm combination. ***, **, and * denote significance at the 1%, 5%, and 10% level, respectively.

Panel A

| | HighForecast = 0 | | HighForecast = 1 | | |
|---|---|---|---|---|---|
| | N | Mean (Std.Dev.) | N | Mean (Std.Dev.) | Diff. (Std.Err.) |
| Ln(Black-Scholes value) | 434 | 7.09 | 589 | 6.94 | -0.15* |
| | | *(1.27)* | | *(1.23)* | *(0.08)* |
| Number of options per grant | 434 | 263.5 | 589 | 190.5 | -72.9** |
| | | *(597.0)* | | *(405.5)* | *(33.2)* |
| Maturity of granted options | 434 | 9.41 | 589 | 9.30 | -0.11 |
| | | *(1.39)* | | *(1.54)* | *(0.09)* |
| Moneyness at grant date (%) | 434 | -0.19 | 589 | -0.10 | 0.09 |
| | | *(2.53)* | | *(2.01)* | *(0.15)* |
| Exercise window | 108 | 6.00 | 204 | 7.01 | 1.01 |
| | | *(3.03)* | | *(8.04)* | *(0.63)* |
| Waited until exercised | 108 | 3.36 | 204 | 4.43 | 1.07* |
| | | *(2.67)* | | *(8.11)* | *(0.62)* |

Panel B

| | LongHolder = 0 | | LongHolder = 1 | | |
|---|---|---|---|---|---|
| | N | Mean (Std. Dev.) | N | Mean (Std. Dev.) | Diff. (Std. Err.) |
| Ln(Black-Scholes value) | 757 | 7.07 | 230 | 6.85 | -0.22** |
| | | *(1.20)* | | *(1.27)* | *(0.09)* |
| Number of options per grant | 757 | 196.5 | 230 | 158.8 | -37.6** |
| | | *(320.9)* | | *(202.0)* | *(17.7)* |
| Maturity of granted options | 757 | 9.42 | 230 | 9.05 | -0.37*** |
| | | *(1.19)* | | *(1.74)* | *(0.12)* |
| Moneyness at grant date (%) | 757 | -0.11 | 230 | -0.35 | -0.25 |
| | | *(2.24)* | | *(2.79)* | *(0.20)* |
| Exercise window | 534 | 7.58 | 173 | 6.32 | -1.26* |
| | | *(8.95)* | | *(7.70)* | *(0.70)* |
| Waited until exercised | 534 | 3.58 | 173 | 6.10 | 2.52*** |
| | | *(8.69)* | | *(7.72)* | *(0.70)* |

Table 2.5: Controlling for whether the realized EPS exceed salient benchmarks

This table presents regression results after including *BeatLastYearEPS* and *BeatConsensusEstimate* as additional control variables. All other variables are defined as in Table 2.3. The dependent variable in all regressions is $Ln\,(y+1)$, where $y$ denotes the compensation variable of interest (in USD '000). Heterogeneity robust standard errors that allow for clustering at the CEO-firm level are reported in parentheses. ***, **, and * denote significance at the 1%, 5%, and 10% level, respectively.

Panel A

| | Options | Rst.Stock | Bonus | Salary | Tot.Comp. |
|---|---|---|---|---|---|
| HighForecast | -0.775*** | 0.108 | -0.353* | -0.118 | -0.181** |
| | *(0.250)* | *(0.337)* | *(0.212)* | *(0.103)* | *(0.074)* |
| Ln(MktCap) | 0.024 | 0.121 | 0.160* | 0.038 | 0.009 |
| | *(0.094)* | *(0.141)* | *(0.095)* | *(0.031)* | *(0.031)* |
| Std.Return | -2.785 | 6.565 | 3.675 | 1.210 | -1.994** |
| | *(2.995)* | *(4.253)* | *(3.112)* | *(0.887)* | *(0.911)* |
| Leverage | -0.154 | -0.145 | -0.885 | -0.430 | 0.066 |
| | *(0.658)* | *(0.919)* | *(0.613)* | *(0.284)* | *(0.221)* |
| MtB | -0.136** | 0.051 | -0.137** | 0.009 | -0.018 |
| | *(0.067)* | *(0.093)* | *(0.063)* | *(0.018)* | *(0.025)* |
| Cash/Assets | 0.841 | -2.432 | 0.501 | -0.901 | -0.087 |
| | *(1.042)* | *(1.618)* | *(1.025)* | *(0.571)* | *(0.402)* |
| R&D/Assets | 5.905*** | 6.924** | -1.540 | -2.386** | 3.014*** |
| | *(1.847)* | *(3.472)* | *(1.626)* | *(1.109)* | *(0.755)* |
| R&D missing | -0.579 | 0.255 | 0.197 | 0.349 | 0.098 |
| | *(0.397)* | *(0.552)* | *(0.282)* | *(0.222)* | *(0.091)* |
| Boardsize | 0.042 | -0.042 | -0.024 | 0.025 | 0.000 |
| | *(0.033)* | *(0.042)* | *(0.036)* | *(0.019)* | *(0.009)* |
| Independent | 0.696 | 0.270 | -0.152 | 0.318** | -0.113 |
| | *(0.507)* | *(0.547)* | *(0.366)* | *(0.144)* | *(0.133)* |
| Return | -0.010 | 0.115*** | 0.165 | 0.001 | -0.010 |
| | *(0.040)* | *(0.029)* | *(0.138)* | *(0.004)* | *(0.017)* |
| EBIT/Assets | 1.551* | -0.772 | 6.024*** | 0.229 | 1.253*** |
| | *(0.830)* | *(0.816)* | *(0.943)* | *(0.217)* | *(0.294)* |
| BeatLastYearEPS | 0.057 | 0.124 | 1.984*** | 0.045** | 0.176*** |
| | *(0.133)* | *(0.148)* | *(0.133)* | *(0.020)* | *(0.031)* |
| BeatConsensusEstimate | -0.129 | 0.278* | 0.622*** | -0.040 | 0.047 |
| | *(0.142)* | *(0.142)* | *(0.124)* | *(0.027)* | *(0.034)* |
| Firm, year, tenure, age, and gender dummies | Yes | Yes | Yes | Yes | Yes |
| $R^2$ | 0.430 | 0.516 | 0.551 | 0.750 | 0.720 |
| N | 5,645 | 5,645 | 5,645 | 5,645 | 5,645 |

Panel B

| | Options | Rst.Stock | Bonus | Salary | Tot.Comp. |
|---|---|---|---|---|---|
| LongHolder | -0.749** | 0.655 | -0.526* | -0.452*** | -0.145* |
| | *(0.313)* | *(0.518)* | *(0.285)* | *(0.152)* | *(0.083)* |
| Ln(MktCap) | 0.055 | 0.298 | 0.091 | 0.132 | 0.071 |
| | *(0.196)* | *(0.289)* | *(0.165)* | *(0.092)* | *(0.053)* |
| Std.Return | 2.755 | 3.458 | 6.079 | 1.758 | -2.503* |
| | *(4.888)* | *(7.998)* | *(4.383)* | *(1.404)* | *(1.329)* |
| Leverage | 0.424 | 0.279 | -2.259*** | -0.870** | 0.171 |
| | *(0.941)* | *(1.212)* | *(0.806)* | *(0.433)* | *(0.329)* |
| MtB | -0.037 | -0.093 | -0.001 | 0.007 | -0.048 |
| | *(0.098)* | *(0.148)* | *(0.075)* | *(0.041)* | *(0.033)* |
| Cash/Assets | -0.405 | 1.626 | 0.300 | -0.506 | 0.371 |
| | *(1.537)* | *(1.743)* | *(0.966)* | *(0.343)* | *(0.495)* |
| R&D/Assets | -2.947 | -6.525* | 5.265* | 1.744 | 0.102 |
| | *(5.168)* | *(3.533)* | *(3.003)* | *(1.495)* | *(1.570)* |
| R&D missing | -0.399 | 0.046 | -0.939* | 0.646 | 0.073 |
| | *(0.671)* | *(1.353)* | *(0.501)* | *(0.480)* | *(0.110)* |
| Boardsize | 0.031 | -0.020 | -0.038 | 0.001 | 0.005 |
| | *(0.042)* | *(0.054)* | *(0.035)* | *(0.011)* | *(0.010)* |
| Independent | 0.334 | 0.724 | -0.332 | 0.181 | 0.082 |
| | *(0.644)* | *(0.729)* | *(0.452)* | *(0.122)* | *(0.138)* |
| Return | -0.003 | 0.097*** | 0.123 | 0.000 | -0.003 |
| | *(0.042)* | *(0.026)* | *(0.113)* | *(0.005)* | *(0.014)* |
| EBIT/Assets | 1.493 | 0.017 | 6.858*** | 0.749** | 1.420*** |
| | *(1.165)* | *(0.953)* | *(1.166)* | *(0.309)* | *(0.323)* |
| BeatLastYearEPS | 0.062 | 0.089 | 1.870*** | 0.006 | 0.177*** |
| | *(0.168)* | *(0.172)* | *(0.160)* | *(0.023)* | *(0.037)* |
| BeatConsensusEstimate | -0.106 | 0.270 | 0.397*** | -0.058 | 0.057 |
| | *(0.171)* | *(0.180)* | *(0.150)* | *(0.041)* | *(0.042)* |
| Firm, year, tenure, age, and gender dummies | Yes | Yes | Yes | Yes | Yes |
| $R^2$ | 0.471 | 0.557 | 0.558 | 0.680 | 0.772 |
| N | 3,729 | 3,729 | 3,729 | 3,729 | 3,729 |

Table 2.6: Optimism measure based on analyst consensus estimates

This table presents the results for regressions using the optimism measure *ExceedConsensus* which is based on the difference between the firm's EPS forecasts and the corresponding analyst consensus forecasts. All other variables are defined as in Table 2.3. The dependent variable in all regressions is $Ln\,(y+1)$, where $y$ denotes the compensation variable of interest (in USD '000). Heterogeneity robust standard errors that allow for clustering at the CEO-firm level are reported in parentheses. ***, **, and * denote significance at the 1%, 5%, and 10% level, respectively.

| | Options | Rst.Stock | Bonus | Salary | Tot.Comp. |
|---|---|---|---|---|---|
| ExceedConsensus | -0.781*** | 0.371 | -0.402 | -0.082 | -0.142* |
| | *(0.244)* | *(0.344)* | *(0.281)* | *(0.121)* | *(0.080)* |
| Ln(MktCap) | 0.031 | 0.212 | 0.129 | 0.034 | 0.016 |
| | *(0.098)* | *(0.145)* | *(0.105)* | *(0.032)* | *(0.034)* |
| Std.Return | -0.278 | 7.210 | 7.715** | 1.550* | -0.830 |
| | *(3.157)* | *(4.570)* | *(3.433)* | *(0.914)* | *(0.979)* |
| Leverage | -0.467 | 0.261 | -0.787 | -0.494* | 0.064 |
| | *(0.730)* | *(0.961)* | *(0.683)* | *(0.298)* | *(0.227)* |
| MtB | -0.131* | 0.035 | -0.116* | 0.009 | -0.018 |
| | *(0.070)* | *(0.093)* | *(0.070)* | *(0.018)* | *(0.026)* |
| Cash/Assets | 1.418 | -1.735 | 0.852 | -0.972* | 0.216 |
| | *(1.100)* | *(1.654)* | *(1.049)* | *(0.582)* | *(0.409)* |
| R&D/Assets | 6.929*** | 8.241** | -1.024 | -2.773*** | 3.112*** |
| | *(1.899)* | *(3.692)* | *(2.160)* | *(0.970)* | *(0.822)* |
| R&D missing | -0.685* | 0.360 | 0.307 | 0.347 | 0.082 |
| | *(0.409)* | *(0.536)* | *(0.293)* | *(0.218)* | *(0.094)* |
| Boardsize | 0.051 | -0.034 | -0.039 | 0.024 | 0.001 |
| | *(0.033)* | *(0.042)* | *(0.038)* | *(0.019)* | *(0.009)* |
| Independent | 0.602 | 0.192 | 0.125 | 0.299** | -0.056 |
| | *(0.525)* | *(0.560)* | *(0.406)* | *(0.150)* | *(0.136)* |
| Return | -0.014 | 0.123*** | 0.263 | 0.002 | 0.000 |
| | *(0.043)* | *(0.031)* | *(0.201)* | *(0.004)* | *(0.013)* |
| EBIT/Assets | 1.730** | -0.193 | 10.674*** | 0.292 | 1.677*** |
| | *(0.794)* | *(0.777)* | *(1.115)* | *(0.206)* | *(0.306)* |
| Firm, year, tenure, age, and gender dummies | Yes | Yes | Yes | Yes | Yes |
| $R^2$ | 0.421 | 0.513 | 0.481 | 0.728 | 0.704 |
| N | 5,389 | 5,389 | 5,389 | 5,389 | 5,389 |

Table 2.7: Optimism measures based on future EPS forecasts

This table presents the results for regressions using the optimism measures *NextYearHigh* and *AvgFutureHigh*. *NextYearHigh* is the fraction of EPS forecasts that exceed the realized EPS in the subsequent year only. *AvgFutureHigh* is the average fraction of EPS forecasts that exceed the realized EPS in all future sample years. All other variables are defined as in Table 2.3. The dependent variable in all regressions is $Ln\,(y+1)$, where $y$ denotes the compensation variable of interest (in USD '000). Heterogeneity robust standard errors that allow for clustering at the CEO-firm level are reported in parentheses. ***, **, and * denote significance at the 1%, 5%, and 10% level, respectively.

| | Options | Options |
|---|---|---|
| NextYearHigh | -0.288* | |
| | *(0.164)* | |
| AvgFutureHigh | | -0.398* |
| | | *(0.223)* |
| Ln(MktCap) | 0.063 | 0.115 |
| | *(0.119)* | *(0.111)* |
| Std.Return | -7.068* | -2.018 |
| | *(4.062)* | *(3.564)* |
| Leverage | -0.054 | -0.917 |
| | *(0.901)* | *(0.772)* |
| MtB | -0.188** | -0.119* |
| | *(0.078)* | *(0.065)* |
| Cash/Assets | 0.899 | 1.325 |
| | *(1.856)* | *(1.779)* |
| R&D/Assets | 4.983 | 4.442 |
| | *(3.781)* | *(3.621)* |
| R&D missing | -0.175 | -0.654 |
| | *(0.501)* | *(0.415)* |
| Boardsize | 0.059 | 0.038 |
| | *(0.044)* | *(0.036)* |
| Independent | 0.897 | 0.470 |
| | *(0.750)* | *(0.586)* |
| Return | 0.001 | 0.003 |
| | *(0.051)* | *(0.040)* |
| EBIT/Assets | 1.557 | 2.002** |
| | *(1.096)* | *(0.879)* |
| Firm, year, tenure, age, and gender dummies | Yes | Yes |
| $R^2$ | 0.533 | 0.456 |
| N | 3,001 | 3,919 |

Table 2.8: CEO optimism, pessimism, and overconfidence

This table presents regression results for optimistic and pessimistic CEOs while controlling for each CEO's overconfidence. *Optimist* (*Pessimist*) is a dummy variable equal to 1 if all EPS forecasts are higher (lower) than the realized EPS, i.e., for CEOs with HighForecast = 1 (HighForecast = 0). *ForecastWidth* is the average width of the range of forecast EPS scaled by the midpoint of the range. All other variables are defined as in Table 2.3. The dependent variable in all regressions is $Ln\,(y+1)$, where $y$ denotes the compensation variable of interest (in USD '000). Heterogeneity robust standard errors that allow for clustering at the CEO-firm level are reported in parentheses. ***, **, and * denote significance at the 1%, 5%, and 10% level, respectively.

| | Options | Rst.Stock | Bonus | Salary | Tot.Comp. |
|---|---|---|---|---|---|
| Optimist | -0.389** | -0.047 | -0.167 | -0.069 | -0.113** |
| | *(0.197)* | *(0.280)* | *(0.203)* | *(0.074)* | *(0.055)* |
| Pessimist | 0.496** | -0.012 | 0.384* | 0.036 | 0.151** |
| | *(0.194)* | *(0.255)* | *(0.208)* | *(0.137)* | *(0.065)* |
| ForecastWidth | -0.107 | -1.485 | -3.184** | -1.380 | -0.219 |
| | *(1.283)* | *(2.105)* | *(1.524)* | *(0.851)* | *(0.536)* |
| ForecastWidth$^2$ | -1.488 | 0.502 | 3.466** | 1.238 | -0.041 |
| | *(1.280)* | *(2.186)* | *(1.740)* | *(0.829)* | *(0.570)* |
| Ln(MktCap) | 0.068 | 0.145 | 0.130 | 0.042 | 0.024 |
| | *(0.093)* | *(0.141)* | *(0.102)* | *(0.031)* | *(0.033)* |
| Std.Return | -1.778 | 6.741 | 6.050* | 1.443 | -1.714* |
| | *(2.884)* | *(4.146)* | *(3.270)* | *(1.007)* | *(0.958)* |
| Leverage | -0.169 | -0.106 | -0.659 | -0.456* | 0.044 |
| | *(0.650)* | *(0.911)* | *(0.674)* | *(0.265)* | *(0.214)* |
| MtB | -0.137** | 0.027 | -0.137* | 0.008 | -0.020 |
| | *(0.066)* | *(0.092)* | *(0.073)* | *(0.019)* | *(0.026)* |
| Cash/Assets | 1.250 | -2.037 | 0.965 | -0.901 | -0.004 |
| | *(1.044)* | *(1.543)* | *(1.013)* | *(0.558)* | *(0.417)* |
| R&D/Assets | 6.446*** | 6.776** | -0.019 | -2.287* | 3.276*** |
| | *(1.820)* | *(3.413)* | *(2.463)* | *(1.183)* | *(0.713)* |
| R&D missing | -0.668* | 0.274 | 0.352 | 0.347 | 0.073 |
| | *(0.393)* | *(0.532)* | *(0.268)* | *(0.215)* | *(0.085)* |
| Boardsize | 0.053* | -0.040 | -0.032 | 0.024 | 0.003 |
| | *(0.032)* | *(0.039)* | *(0.036)* | *(0.018)* | *(0.008)* |
| Independent | 0.700 | 0.210 | 0.089 | 0.294** | -0.073 |
| | *(0.494)* | *(0.522)* | *(0.383)* | *(0.135)* | *(0.128)* |
| Return | -0.016 | 0.123*** | 0.290 | 0.002 | 0.000 |
| | *(0.042)* | *(0.030)* | *(0.213)* | *(0.004)* | *(0.012)* |
| EBIT/Assets | 1.468** | -0.130 | 10.983*** | 0.209 | 1.735*** |
| | *(0.730)* | *(0.731)* | *(1.067)* | *(0.190)* | *(0.286)* |
| Firm, year, tenure, age, and gender dummies | Yes | Yes | Yes | Yes | Yes |
| $R^2$ | 0.432 | 0.516 | 0.497 | 0.759 | 0.723 |
| N | 5,890 | 5,890 | 5,890 | 5,890 | 5,890 |

Table 2.9: Controlling for the CEO's portfolio of company stock and options

This table presents regression results after including the total dollar value of the CEO's portfolio of company stock and options at the beginning of the fiscal year (*CEO Investment*) as an additional control variable. All other variables are defined as in Table 2.3. The dependent variable in all regressions is $Ln\,(y+1)$, where $y$ denotes the compensation variable of interest (in USD '000). Heterogeneity robust standard errors that allow for clustering at the CEO-firm level are reported in parentheses. ***, **, and * denote significance at the 1%, 5%, and 10% level, respectively.

Panel A

| | Options | Rst.Stock | Bonus | Salary | Tot.Comp. |
|---|---|---|---|---|---|
| HighForecast | -0.703*** | 0.056 | -0.848*** | -0.102 | -0.193** |
| | *(0.270)* | *(0.360)* | *(0.238)* | *(0.102)* | *(0.075)* |
| Ln(MktCap) | 0.091 | 0.143 | 0.238** | 0.062** | 0.012 |
| | *(0.106)* | *(0.149)* | *(0.101)* | *(0.030)* | *(0.030)* |
| Std.Return | -2.570 | 6.861 | 7.260** | 1.389 | -1.881** |
| | *(3.310)* | *(4.262)* | *(3.056)* | *(0.889)* | *(0.928)* |
| Leverage | -0.108 | -0.300 | -0.971 | -0.324 | 0.101 |
| | *(0.698)* | *(0.936)* | *(0.638)* | *(0.254)* | *(0.226)* |
| MtB | -0.203*** | 0.074 | -0.289*** | -0.015 | -0.048* |
| | *(0.067)* | *(0.103)* | *(0.083)* | *(0.019)* | *(0.025)* |
| Cash/Assets | 1.728 | -2.667 | 2.751** | -0.602 | 0.377 |
| | *(1.181)* | *(1.671)* | *(1.070)* | *(0.493)* | *(0.386)* |
| R&D/Assets | 7.075*** | 6.127* | 2.368 | -1.878* | 3.495*** |
| | *(1.924)* | *(3.311)* | *(2.736)* | *(1.135)* | *(0.747)* |
| R&D missing | -0.773* | 0.138 | 0.604* | 0.248 | 0.119 |
| | *(0.428)* | *(0.568)* | *(0.320)* | *(0.190)* | *(0.098)* |
| Boardsize | 0.068** | -0.033 | -0.032 | 0.025 | 0.010 |
| | *(0.033)* | *(0.041)* | *(0.034)* | *(0.016)* | *(0.008)* |
| Independent | 0.894* | 0.244 | 0.206 | 0.295** | -0.008 |
| | *(0.517)* | *(0.547)* | *(0.392)* | *(0.123)* | *(0.136)* |
| Return | -0.007 | 0.101*** | 0.286 | -0.001 | 0.000 |
| | *(0.038)* | *(0.028)* | *(0.219)* | *(0.004)* | *(0.012)* |
| EBIT/Assets | 1.958** | 0.369 | 11.894*** | 0.312** | 2.060*** |
| | *(0.798)* | *(0.787)* | *(1.176)* | *(0.140)* | *(0.278)* |
| CEO investment | 0.001 | 0.000 | 0.001 | 0.000 | 0.000 |
| | *(0.000)* | *(0.000)* | *(0.001)* | *(0.000)* | *(0.000)* |
| Firm, year, tenure, age, and gender dummies | Yes | Yes | Yes | Yes | Yes |
| $R^2$ | 0.444 | 0.529 | 0.511 | 0.783 | 0.739 |
| N | 5,501 | 5,501 | 5,501 | 5,501 | 5,501 |

Panel B

| | Options | Rst.Stock | Bonus | Salary | Tot.Comp. |
|---|---|---|---|---|---|
| LongHolder | -0.823*** | 0.577 | -0.555** | -0.377*** | -0.164* |
| | *(0.310)* | *(0.475)* | *(0.267)* | *(0.119)* | *(0.085)* |
| Ln(MktCap) | 0.102 | 0.366 | 0.028 | 0.132* | 0.056 |
| | *(0.201)* | *(0.282)* | *(0.160)* | *(0.072)* | *(0.053)* |
| Std.Return | -0.139 | 9.027 | 10.459*** | 1.927 | -1.884 |
| | *(4.914)* | *(8.015)* | *(4.001)* | *(1.256)* | *(1.317)* |
| Leverage | 0.544 | -0.296 | -1.222 | -0.790** | 0.048 |
| | *(0.923)* | *(1.281)* | *(0.860)* | *(0.370)* | *(0.278)* |
| MtB | -0.100 | -0.141 | 0.013 | -0.004 | -0.055* |
| | *(0.100)* | *(0.140)* | *(0.075)* | *(0.035)* | *(0.032)* |
| Cash/Assets | 0.759 | 3.113* | 0.843 | -0.381 | 0.904** |
| | *(1.375)* | *(1.684)* | *(0.852)* | *(0.334)* | *(0.425)* |
| R&D/Assets | -1.669 | 0.192 | 4.349* | 1.222 | 1.289 |
| | *(4.681)* | *(3.935)* | *(2.508)* | *(1.092)* | *(1.481)* |
| R&D missing | -0.607 | -0.563 | -0.373 | 0.410 | 0.130 |
| | *(0.751)* | *(1.557)* | *(0.469)* | *(0.485)* | *(0.113)* |
| Boardsize | 0.057 | -0.022 | -0.040 | 0.007 | 0.009 |
| | *(0.044)* | *(0.053)* | *(0.038)* | *(0.010)* | *(0.010)* |
| Independent | 0.149 | 0.716 | 0.029 | 0.186** | 0.058 |
| | *(0.632)* | *(0.707)* | *(0.489)* | *(0.091)* | *(0.134)* |
| Return | 0.015 | 0.086*** | 0.202 | -0.006 | 0.008 |
| | *(0.036)* | *(0.024)* | *(0.169)* | *(0.007)* | *(0.009)* |
| EBIT/Assets | 1.792* | 0.679 | 11.273*** | 0.564** | 2.128*** |
| | *(1.073)* | *(0.925)* | *(1.525)* | *(0.225)* | *(0.288)* |
| CEO investment | 0.001 | -0.001*** | 0.000 | -0.001 | 0.000* |
| | *(0.001)* | *(0.000)* | *(0.001)* | *(0.001)* | *(0.000)* |
| Firm, year, tenure, age, and gender dummies | Yes | Yes | Yes | Yes | Yes |
| $R^2$ | 0.485 | 0.573 | 0.511 | 0.735 | 0.790 |
| N | 3,782 | 3,782 | 3,782 | 3,782 | 3,782 |

Table 2.10: Effect on the fraction of incentives in the CEO's total compensation

This table presents regression results regarding the fraction of incentive pay in the CEO's total compensation. *Incentive Compensation/Total Compensation* is the sum of *Bonus*, *Restricted Stock*, and *Options* divided by *Total Compensation*. All other variables are defined as in Tables 2.3 and 2.9. Heterogeneity robust standard errors that allow for clustering at the CEO-firm level are reported in parentheses. ***, **, and * denote significance at the 1%, 5%, and 10% level, respectively.

| Dependent Variable: Incentive Compensation/Total Compensation | | | | |
|---|---|---|---|---|
| | (1) | (2) | (3) | (4) |
| HighForecast | -0.066*** | -0.058*** | | |
| | *(0.017)* | *(0.017)* | | |
| LongHolder | | | -0.020 | -0.021 |
| | | | *(0.031)* | *(0.030)* |
| Ln(MktCap) | -0.011 | -0.009 | -0.001 | 0.005 |
| | *(0.007)* | *(0.008)* | *(0.015)* | *(0.014)* |
| Std.Return | -0.240 | -0.205 | 0.058 | 0.044 |
| | *(0.239)* | *(0.254)* | *(0.437)* | *(0.461)* |
| Leverage | -0.077 | -0.099* | -0.053 | -0.055 |
| | *(0.057)* | *(0.059)* | *(0.085)* | *(0.086)* |
| MtB | -0.003 | -0.011** | -0.009 | -0.011 |
| | *(0.005)* | *(0.006)* | *(0.008)* | *(0.008)* |
| Cash/Assets | 0.027 | 0.125 | 0.299*** | 0.334*** |
| | *(0.095)* | *(0.096)* | *(0.110)* | *(0.108)* |
| R&D/Assets | 0.749*** | 0.814*** | 0.064 | 0.055 |
| | *(0.185)* | *(0.193)* | *(0.370)* | *(0.387)* |
| R&D missing | 0.024 | 0.029 | -0.065 | -0.072 |
| | *(0.025)* | *(0.028)* | *(0.056)* | *(0.063)* |
| Boardsize | -0.002 | -0.001 | -0.001 | -0.002 |
| | *(0.002)* | *(0.002)* | *(0.003)* | *(0.003)* |
| Independent | 0.004 | 0.020 | 0.019 | 0.020 |
| | *(0.033)* | *(0.035)* | *(0.041)* | *(0.042)* |
| Return | 0.005* | 0.007 | 0.003 | 0.004 |
| | *(0.003)* | *(0.004)* | *(0.002)* | *(0.003)* |
| EBIT/Assets | 0.427*** | 0.468*** | 0.412*** | 0.420*** |
| | *(0.061)* | *(0.065)* | *(0.072)* | *(0.076)* |
| CEO investment | | 0.000 | | 0.000 |
| | | *(0.000)* | | *(0.000)* |
| Firm, year, tenure, age, and gender dummies | Yes | Yes | Yes | Yes |
| $R^2$ | 0.533 | 0.543 | 0.556 | 0.567 |
| N | 5,890 | 5,501 | 3,980 | 3,782 |

# Chapter 3

# The Unintended Effects of the Sarbanes-Oxley Act

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## 3.1 Introduction

The Sarbanes-Oxley Act of 2002 (SOX) was introduced after a series of corporate scandals including those leading to the bankruptcy of Enron and WorldCom and the collapse of Arthur Andersen. It has been commonly considered the single most important piece of securities legislation pertaining to corporate governance and financial disclosure since the Securities Acts of the 1930s. SOX was intended to restore investor confidence by placing new rules and restrictions on several corporate entities in order to improve the accuracy and reliability of corporate disclosures. Broadly speaking, SOX was aimed at improving corporate governance for public US companies.

In this paper, we provide evidence of an unintended effect of the SOX legislation on small public US firms (see also Romano (2005, p. 1589). More precisely, we find that exempting nonaccelerated filers—firms with a public float of less than $75 million—from compliance with Section 404 has lowered the takeover activity involving such firms and led to a reduction in the takeover premiums that were paid in the acquisitions. These results suggest that SOX, which was drafted as a reform to strengthen governance, may in fact have weakened corporate governance for nonaccelerated filers (*small* firms) by adversely affecting the market for corporate control.

Significant changes in governance structure, accounting standards, and reporting were introduced on account of the new regulations, which imposed substantial compliance costs, especially on small companies (Engel, Hayes, and Wang (2007), Leuz (2007), Piotroski and Srinivasan (2008), Iliev (2009)). In addition, scholars have suggested that SOX altered the incentives to take risks (Ribstein (2002), Romano (2005), Holmstrom and Kaplan (2003), Bargeron, Lehn, and Zutter (2010)), led to delistings and significant exits from the public market especially for small firms (Kamar, Karaca-Mandic, and Talley) (2007)), and increased incentives for small firms to remain small (Gao, Wu, and Zimmerman (2009)).

Among the new rules, Section 404—introduced by the Securities and Exchange Commission (SEC) in May 2003—is widely regarded as the most onerous and costly regulation. The section requires companies to employ procedures to monitor and control the financial reporting process and to assess the effectiveness of such internal controls and procedures in an annual management report. Furthermore, Section 404 requires that an outside auditor attest to the assessment of the company's controls alongside the company's annual report.

Section 404 became binding for the majority of US public companies (accelerated filers) from 2004 onwards. However, companies with a public float—equity that is not held by affiliates of the company—of less than $75 million (nonaccelerated filers) were granted several exemptions from compliance. For these companies, the management's assessment of the internal control systems was not required before 2007, and the attestation by an outside auditor was not required before June 2010.

The size-dependent cutoff for mandatory compliance with Section 404 decreases the net benefits of taking over a nonaccelerated filer for a public US company, if after the acquisition the public float of the combined venture exceeds the $75 million threshold. In such cases, Section 404 becomes binding for the newly acquired entity, and the acquirer is faced with the associated costs.[1] Furthermore, uncertainty about the financial reporting mechanisms and internal controls of a nonaccelerated filer might necessitate a more thorough due diligence process prior to the acquisition and increase the effective takeover costs even more. For these reasons, we hypothesize that the size-dependent nature of Section 404 has made takeovers that would trigger mandatory compliance less attractive.

Extensive theoretical and empirical work, for example by Manne (1965), Jensen (1988), and Scharfstein (1988), supports the view that a well-functioning takeover market can address governance problems. If Section 404 has made takeovers that would trigger mandatory compliance more costly, and if this effect outweighs the incentives to merge in order to benefit from potential economies of scale in the compliance costs associated with other provisions of SOX, then we expect the market for corporate control to have weakened. Therefore, an unintended effect of granting exemptions to small companies might have been a weakening of corporate governance.

Among the empirical literature on the effects of the Sarbanes-Oxley Act, our article is most closely related to the work of Engel, Hayes, and Wang (2007), Iliev (2010), Gao, Wu, and Zimmerman (2009), and Kamar, Karaca-Mandic, and Talley (2007). Engel, Hayes, and Wang (2007) and Kamar, Karaca-Mandic, and Talley (2007) examine the effect of SOX on the going-private decisions of firms. They find that the propensity of

[1] Note that while nonaccelerated filers might have expected that they would eventually have to comply with Section 404 in the future, the mere postponement of the compliance costs has significant value. Assuming yearly compliance costs of $0.7 million and a discount rate of 5%, a five-year postponement reduces the present value of all future compliance costs by about $3 million—a substantial amount for small firms.

small US companies to exit the public market has increased since the passage of SOX, while there seems to be little effect on the going-private decisions of large firms. Gao, Wu, and Zimmerman (2009) and Iliev (2010) study the effects of SOX in general, and specifically on nonaccelerated filers. Iliev (2010) documents that compliance with Section 404 imposed significant costs, led to more conservative reporting, and was associated with lower buy-and-hold returns of accelerated filers over the three-year period starting with the signing of SOX. He interprets his findings as evidence that compliance with Section 404 was indeed perceived as imposing net costs. Gao, Wu, and Zimmerman (2009) examine the incentives for firms to stay below the $75 million threshold and find that firms actively managed their public float to do so.

Our work adds to the existing strand of literature in that it explores the effects of postponing mandatory compliance with Section 404 on the takeover market for small public US firms. In order to do so, we examine the merger activity involving US firms with a public float of less than $75 million (nonaccelerated filers: *small* firms) and US firms with a public float in excess of $75 million (accelerated filers: *large* firms) over the period from 2001 to 2007. We find that after the passage of Section 404 there was a decline both in the probability that a small public US firm is taken over by a public US acquirer and in the premiums paid in such transactions. We find no change in the probability that a small public US firm is bought by any other type of acquirer, nor do we find a decrease in the premiums that are paid in such takeovers. Furthermore, we explore the effect of the decline of takeover activity on firms' leverage and cash holdings and find that small public US firms decreased their leverage after the introduction of Section 404, whereas large ones increased their leverage and decreased their cash holdings.

The rest of the article is organized as follows. Section 3.2 gives a brief overview of the SOX legislation, and Section 3.3 introduces a stylized model of the effects of compliance costs on corporate takeovers. Section 3.4 discusses our data, Section 3.5 describes our empirical methodology and presents the results, and Section 3.6 concludes.

## 3.2 Review of the SOX legislation

The Sarbanes-Oxley Act was introduced in 2002 after a series of corporate scandals that involved accounting irregularities and share price manipulation. The most notorious of these scandals is perhaps the collapse of the energy company Enron. On November 8, 2001, Enron filed restated financial results with the Securities and Exchange Commission (SEC). The restatement was made after several weeks of SEC investigations, which revealed various accounting irregularities and showed that the company was more heavily indebted than its earlier statements had indicated. Finally, on December 2, 2001, Enron filed for bankruptcy protection, and similar accounting irregularities and cases of corporate misconduct in a number of firms, including Tyco and Worldcom, were identified by the SEC several months later.

Between December 2001 and April 2002, the Senate Committee on Banking, Housing, and Urban Affairs and the House Committee on Financial Services held numerous hearings concerning the collapse of Enron and related accounting and investor protection issues. These hearings and the corporate scandals that followed led to the passage of SOX. The Senate and the House reached consensus on the act on July 24 and voted almost unanimously for the act on July 25, 2002. President George W. Bush signed the bill into law on July 30, 2002.

Section 404 of the act was introduced by the SEC in May 2003, and initially, accelerated filers (firms with a public float greater than or equal to $75 million) were expected to comply in the fiscal years ending on or after June 15, 2004. Nonaccelerated filers (firms with a public float smaller than $75 million) were meant to comply in the fiscal years ending on or after April 15, 2005. However, public outcry led to the postponement of required compliance with Section 404. In February 2004, the compliance date for accelerated filers was extended to fiscal years ending on or after November 15, 2004, and the compliance date for nonaccelerated filers was pushed back to fiscal years ending on or after July 15, 2005. Further extensions of one year each were granted to nonaccelerated filers in March and September 2005. In August 2006, the compliance date for nonaccelerated filers was once more postponed to December 15, 2007, with the additional relief that an auditor's attestation would not be required before December 2008. Again, in June 2008, an additional extension was granted so that the auditor's attestation was not required before December 15, 2009. Later on, this deadline was again postponed to June 2010. The SEC release approving the extensions specifically stated that this would reduce the "cost of compliance" for small firms.

## 3.3 A simple model

In this section, we argue that the well-meant extensions of the compliance dates described in the previous section might have had an unintended, negative effect on the market for corporate control for the exempted firms (small public US firms.) In order to do so we make use of a slightly modified version of the model of corporate takeovers introduced by Grossman and Hart (1980) to show how both takeover probabilities and takeover premiums are affected by the costs of complying with a given regulation. First, we derive the probability of a takeover and the premium paid conditional on a takeover in a setting without any compliance costs as a benchmark case. Thereafter, we examine the effects of compliance costs on acquisitions that may trigger or remove the necessity to comply.

### 3.3.1 Benchmark case: no compliance costs

Consider a firm that is owned by a large number of small shareholders,[2] which is currently valued at $V_I > 0$, and that would be valued at $V_R \geq V_I$ in case of a successful takeover.[3] That is, assume that the value of the firm is higher in the hands of the raider than under the incumbent management, and define the total surplus that is created in the takeover as $\Delta \equiv V_R - V_I$. Furthermore, assume that in case of a successful takeover, the raider is able to capture an amount $\phi(\Delta) \leq \Delta$ of the total surplus created,[4] such that the first derivative of $\phi(\Delta)$ with respect to $\Delta$ satisfies $0 \leq \phi'(\Delta) \leq 1$. That is, the raider can extract at most all of the surplus that is created, the amount the raider extracts is weakly increasing in the surplus, and for every additional dollar of surplus at most one additional dollar can be extracted. Finally, assume that the raider faces private costs $c \geq 0$ from organizing the takeover, where $c$ is a random variable with cumulative distribution function $F_c$ and density function $f_c$.

It is a well-known result that in this setting, shareholders will tender their shares if the price $p$ offered by the raider satisfies

$$p \geq V_R - \phi(\Delta) = V_I + \Delta - \phi(\Delta),$$

[2] Specifically, assume that each shareholder believes that her decision on whether or not to tender her shares in case of a bid by a raider does not change the probability that the takeover is successful.

[3] In our setting, a profit-maximizing raider would never bid for a firm if $V_R < V_I$.

[4] $\phi(\Delta)$ might arise for example from a toehold in the target firm or from a provision in the target's corporate charters that allows the raider to exclude minority shareholders from a fraction of the increase in value.

and a profit-maximizing raider offering the lowest price $p^*$ that will lead to a successful takeover will make a total profit of

$$V_R - p^* - c = \phi(\Delta) - c.$$

Clearly, the raider will only bid for the target if $\phi(\Delta) \geq c$, and it follows immediately that the probability that the firm will be taken over is

$$\sigma(\Delta) \equiv \Pr(c \leq \phi(\Delta)) = F_c(\phi(\Delta)).$$

The premium paid by the raider in case of a takeover amounts to

$$\rho(\Delta) \equiv \frac{p^*}{V_I} - 1 = \frac{V_R - \phi(\Delta)}{V_I} - 1 = \frac{\Delta - \phi(\Delta)}{V_I}.$$

Differentiating the probability of a takeover and the premium conditional on a takeover with respect to $\Delta$ gives us

$$\sigma'(\Delta) = f_c(\phi(\Delta))\,\phi'(\Delta) \geq 0$$

and

$$\rho'(\Delta) = \frac{1 - \phi'(\Delta)}{V_I} \geq 0.$$

It can be seen that both the probability of a takeover and the premium conditional on a takeover weakly increase in the surplus $\Delta$ created by the raider.

### 3.3.2 The effect of costly compliance

Let us now examine how the probability that a firm is taken over and the premium paid in case of a takeover are affected by the introduction of some regulation with compliance costs $k > 0$. We assume that for $i \in \{I, R\}$ we have $V_i(k) < V_i$, where $V_i$ denotes the value of the firm in the absence of any compliance costs, and $V_i(k)$ denotes the value of the firm in case it has to comply with the regulation. Furthermore, we assume that $V_R(k) - V_I(k) = V_R - V_I = \Delta$. That is, we assume that compliance is costly, and that the decrease in the firm's value due to the compliance costs does not depend on who owns the firm. Finally, let us assume that the need to comply may be triggered or removed by an acquisition, so that three cases can be distinguished: acquisitions that trigger compliance, acquisitions that remove the necessity to comply, and acquisitions that do not affect whether a firm needs to comply.

Clearly, if an acquisition triggers compliance, the surplus that is created by the raider is reduced, and vice versa, if an acquisition removes the necessity to comply, the surplus is larger than in the benchmark case. Thus, if a takeover triggers (removes) the need to comply with the regulation, both the probability of a takeover and the premium paid conditional on a takeover are weakly smaller (larger) than in the benchmark case. In case a takeover neither triggers nor removes the need to comply, the probability of a takeover is exactly as in the benchmark case. The takeover premium remains unchanged if the target does not have to comply either if owned by the raider or under its current management, and the premium weakly increases in case the firm must comply in both cases.[5]

Applied to the specific setting of exempting small public US firms from compliance with Section 404, the model delivers four testable implications. First, the introduction of Section 404 should lead to a decline in the probability that a small public US firm is taken over by a public US acquirer as well as to a decline in the premiums paid in such acquisitions. Second, the probability that a large public US firm is taken over by a public US acquirer should remain unchanged. Third, for small public US firms we expect no increase in the probability of being acquired by any *other* (i.e., not public US) type of acquirer, nor in the takeover premiums of such acquisitions. Fourth, we expect to find an increase in the probability that a large public US firm is bought by a nonpublic or non-US ("other") acquirer, as well as an increase in the premiums that these acquirers pay.

## 3.4 Data

Our main source for acquisition data is the SDC Platinum database, from which we obtain all M&A transactions of public US targets between 2001 and 2007. We include only completed acquisitions for which the announcement date, the target's share price four weeks and one day prior to the announcement, and the price per share paid by the acquirer are known. Furthermore, we consider only transactions in which the acquirer has crossed the threshold of 50% ownership in the target,[6] exclude financial and public sector firms, and require that financial information for the target be available in the

[5] Note that $V_I(k) < V_I$, so that $(\Delta - \phi(\Delta))/V_I(k) > (\Delta - \phi(\Delta))/V_I$.

[6] We drop observations if information on the percentage of shares acquired or the percentage of shares owned after the acquisition is not available.

Compustat database for the fiscal year that precedes the announcement of the takeover. Finally, we require that the target be listed on one of the following six exchanges: NYSE, NASDAQ, American Stock Exchange, Chicago Stock Exchange, Pacific Stock Exchange, or Philadelphia Stock Exchange.

We then create a sample of all public US firms in the Compustat database that are listed on one of the six stock exchanges we consider and that have a year-end market capitalization of less than $500 million. As before, we exclude public sector and financial firms and merge the information on the M&A transactions with this sample. That is, if a firm in our sample is acquired in a given year, we match the acquisition information with the Compustat observation of the preceding year.[7]

Finally, we classify each firm in our sample in each year as either *small* or *large*. We classify firms as *small* if the public float of these firms is below $75 million, and as *large* if the public float is above $75 million. Clearly, all firms with a market capitalization of less than $75 million are classified as small, since the public float cannot exceed the market capitalization. Further, we classify all firms with a market capitalization between $300 million and $500 million as large, since these firms are likely to have a public float that exceeds $75 million.[8] For all firms with a market capitalization between $75 million and $300 million, we collect the firms' public float from the 10K filings with the help of a web-crawling program and manually check the results.[9] Furthermore, for all takeover observations, we distinguish between acquisitions by public US firms that are listed on one of the six exchanges we consider and that are neither public sector nor financial firms (*public US acquirers*) and takeovers by any other firms (*other acquirers*).

## 3.5 Results

### 3.5.1 Number of firms and takeovers

Table 3.1 presents the numbers of small and large public US firms in our sample, the number of acquisitions, and the percentage of acquired firms. The sample period is 2001 to 2007 (based on the year in which the acquisitions were announced). In Panel A, only

[7] We match each target with Compustat information of the fiscal year that precedes the announcement of the takeover, because it is not guaranteed that a target files financial information in the year in which it is acquired.

[8] To ensure comparability between our two groups, we exclude firms that have a market capitalization that is greater than $500 million from the sample.

[9] Observations for which public float information is missing are dropped from the sample.

public US acquirers are taken into account. Panel B shows the results for all other types of acquirers (non-US, nonpublic). On average we observe 777 large firms and 958 small firms, of which 5.10% and 5.48% are a takeover target in a given year, respectively. For large firms, the average probability of being acquired by a public US acquirer (by an "other acquirer") is 2.16% (2.94%), and for small public US firms it is 2.18% (3.29%).

### 3.5.2 Effect of Section 404 on takeover probabilities

In order to examine whether the passage of Section 404 has had a detrimental effect on the takeover activity involving nonaccelerated public US firms, we estimate linear probability models of the form

$$Acquired = \alpha + \beta_1 \cdot S404 \cdot Small + \beta_2 \cdot S404 + \beta_3 \cdot Small + \gamma' X + \varepsilon.$$

The unit of observation for these estimations is a firm-year combination. For a given observation, *Acquired* is a dummy variable that takes the value 1 if an acquisition of the firm is announced in that year, and 0 otherwise. $S404$ is a dummy that takes the value 1 for all years after 2003, *Small* is a dummy that takes the value 1 for small firms, and $X$ is a set of firm-level control variables, industry dummies, and year dummies.[10] The control variables are the natural logarithm of the firm's market capitalization, the firm's market-to-book ratio (sum of market capitalization and total long-term debt divided by book value of total assets), EBIT divided by total assets, CAPEX divided by total assets, and the firm's leverage (total long-term debt divided by total assets). Industry fixed effects are formed at the level of the first two digits of the firms' SIC codes. To allow for heterogeneity and correlation of the error terms across observations within a given industry, we calculate heterogeneity-robust standard errors that allow for clustering at the industry level.

Table 3.2 presents the results of these estimations. In Panel A, we take only acquisitions by public US acquirers into account, and in Panel B, we only consider acquisitions by other acquirers. Furthermore, we run separate regressions for small public US firms (column 1) and for large public US firms (column 2) as well as pooled regressions for all public US firms (columns 3 and 4). In all regressions, we include the full set of firm-level

[10] In the regressions that include year fixed effects, we drop the $S404$ dummy, as it is perfectly explained by a linear combination of the year dummies.

control variables and industry dummies, whereas the year fixed effects are only included in the pooled regressions which are reported in column 4.

In the regressions reported in columns 1 and 2, we essentially compare the probabilities of being a takeover target, conditional on covariates, before and after the introduction of Section 404 for small and for large public US firms, while distinguishing between different types of acquirers. Consistent with the predictions of the model introduced in Section 3.3, we find that the coefficient estimate for the $S404$ dummy is negative and significant in the regression estimating the effect of Section 404 on the probability that a small public US firm is acquired by a public US acquirer (Panel A, column 1). In addition, we find that for large public US firms the probability of being acquired by a public US firm was unaffected by Section 404 (Panel A, column 2).

We next estimate the effect of Section 404 on the probability of being taken over by any other type of acquirer (Panel B). This can essentially be interpreted as a placebo test, as for small public US firms there should not be any affect of Section 404 on the probability of these acquisitions. Consistent with this prediction, we find that Section 404 has had no effect on the probability that a small firm is bought by acquirers other than public US firms. In addition, we find that the estimated effect of Section 404 on the probability that a large public US firm is acquired by such other acquirers is positive and significant.[11]

Finally, columns 3 and 4 display the estimation results for the regressions in which we include both small and large public US firms. The coefficient of interest in these regressions is the coefficient on the interaction term between the $S404$ dummy and the $Small$ dummy ($S404 \cdot Small$), as it estimates the effect of Section 404 on the probability of being acquired for small firms by comparing the changes in the acquisition probabilities for small and large firms from before the year 2003 to after the year 2003.[12] As is to be expected, the estimation results of columns 3 and 4 confirm our previous findings. Relative to the probability for large public US firms, the probability of being bought by a public US acquirer has decreased for small public US firms after the introduction of Section 404 (Panel A). This is consistent with our hypothesis that the costs of compliance

[11] This finding is consistent with existing evidence that some firms chose to go private after the passage of SOX in order to avoid the associated compliance costs.

[12] Note that the estimated coefficients on the interaction term in columns 3 and 4 are almost identical within each of the two panels. In combination with the fact that the only difference between the two columns is the inclusion of year dummies, we can infer that the results are not driven by any omitted macro variables such as GDP growth or other economic indicators that vary from year to year.

that would be triggered in case of an acquisition have indeed deterred some potential public acquirers from taking over a small public US firm. In a similar fashion, the results presented in Panel B reflect the earlier finding that the probability of being acquired by a nonpublic or non-US firm has increased for large public US firms but remained unchanged for small firms.

In summary, the estimation results presented in Table 3.2 provide some evidence that the introduction of Section 404—and more specifically the exemption of small firms from compliance—might indeed have had a detrimental effect on the takeover market for small public US firms. Consistent with the predictions of our model, we find evidence for a decrease in the probability that a small firm is acquired by a public US acquirer and for an increase in the probability that a large firm is acquired by any other type of acquirer. At the same time, we find no evidence for an effect of Section 404 on the probability that a small (large) firm is being acquired by "other" (by public US) acquirers.

While at first glance the magnitude of the estimated effect appears to be small—around half a percentage point for the effect of Section 404 on the probability that a small firm is acquired by a public US firm—note that the unconditional probabilities of being acquired are very small as well. Only about 2.5% of all small public firms in our sample were acquired by another public US firm in a given year before Section 404 was introduced, and the probability of being taken over by any type of acquirer was only 5.8%. Thus, a reduction of half a percentage point, while seemingly small in absolute terms, is in fact a significant reduction when seen in the light of the unconditional takeover probabilities.

### 3.5.3 Effect of Section 404 on takeover premiums

We continue our analysis by examining the effect of Section 404 on the premiums paid in takeovers of public US targets. As before, we consider the effect on takeover premiums for small and large public targets, both separately and relative to each other, and distinguish between public US acquirers and all other types of acquirers. In order to study the impact of Section 404 we estimate models of the form

$$Premium = \alpha + \beta_1 \cdot S404 \cdot Small + \beta_2 \cdot S404 + \beta_3 \cdot Small + \gamma' X + \varepsilon,$$

where *Premium* is the natural logarithm of the quotient of the price per share paid by the acquirer and the target's share price four weeks before the takeover announcement.[13] $S404$ and *Small* are dummy variables for the years after 2003 and for small firms, as before, and $X$ is a set of control variables, industry dummies, and year dummies.[14] The control variables are the percentage of target shares owned by the acquirer before the acquisition (toehold), the natural logarithm of the quotient of the target's share price one day prior to the announcement and the share price four weeks prior to the announcement (runup), a dummy that equals 1 if the target and the acquirer share the same primary SIC code, the target's market-to-book ratio (sum of market capitalization and total long-term debt divided by the book value of total assets), the target's CAPEX divided by the book value of total assets, and the target's cash holdings divided by the book value of total assets. Industry fixed effects are formed at the level of the first two digits of the firms' SIC codes. Furthermore, to allow for heterogeneity and correlation of the error terms across observations within a given industry, we calculate heterogeneity-robust standard errors that allow for clustering at the industry level in all specifications.

Table 3.3 presents the results of these regressions. As for the analyses regarding the effect of Section 404 on the probability of being a takeover target, we run separate regressions for small and for large public US targets only (columns 1 and 2) as well as pooled regressions for all targets (columns 3 and 4), and we distinguish between acquisitions by public US acquirers (Panel A) and other acquirers (Panel B). The estimation results displayed in columns 1 and 2 are consistent with the predictions of the model introduced in Section 3.3. The significant and negative point estimate for the coefficient on the $S404$ dummy in column 1, Panel A, suggests that for small targets there has indeed been a decline in the premiums paid by public US acquirers. In contrast, we do not find evidence for a decline in the premiums paid for large targets. Shifting focus to the premiums paid in acquisitions by other acquirers (Panel B), we cannot reject the hypothesis that Section 404 has had no effect on the premiums for both small and large public US targets. Columns 3 and 4, which display the results for the regressions that take all targets into account, confirm these findings—the estimated coefficient on the interaction term between the $S404$ and the *Small* dummy is negative and significant in

[13] To remove the effect of outliers, we winsorize all premiums at the 10% level.

[14] In the regressions that include year fixed effects, we drop the $S404$ dummy, as it is perfectly explained by a linear combination of the year dummies.

the regressions for acquisitions by public US acquirers (Panel A). The point estimate of $-0.060$ translates into a reduction of about \$5 million—from \$86 million to \$81 million—in the average price paid by a public US acquirer for a small public US target with a market capitalization of \$60 million (the average size of a small target in our sample). Given that the the model of Section 3.3 suggests that the reduction in value due to the costs of compliance is shared by the raider and the target shareholders, these findings imply a lower bound for the costs of compliance of about \$5 million.[15]

### 3.5.4 Effects of Section 404 on leverage and cash holdings

At last, we set out to investigate whether the passage of Section 404 has had an effect on the leverage and cash holdings of small public US firms. We hypothesize that as the threat of a takeover goes down, firms might choose lower levels of leverage and hold more cash. In order to further investigate these hypotheses, we estimate regressions of the form

$$Y = \alpha + \beta_1 \cdot S404 \cdot Small + \beta_2 \cdot Small + \text{Firm FE} + \text{Year FE} + \varepsilon.$$

As before, we estimate separate regressions for small and for large firms (columns 1 and 2, respectively) as well as regressions for both types of firms (columns 3 and 4), and we calculate heterogeneity-robust standard errors that allow for clustering at the firm level in all specifications.[16]

Table 3.4 presents the results for the effect on leverage (long-term debt divided by total assets) in Panel A, and the effect on cash holdings (cash divided by total assets) in Panel B. The estimates for the coefficient on the $S404$ dummy in columns 1 and 2 as well as on the interaction term between the $S404$ and the $Small$ dummy in columns 3 and 4 suggest that small public firms have indeed reduced their leverage after the introduction of Section 404, whereas large firms have increased their leverage. This finding is consistent with the hypothesis that a reduction in the takeover threat might allow managers to choose lower levels of leverage (Zwiebel (1996), Garvey and Hanka (1999)). With respect to the effect on cash holdings, the estimation results suggest that

[15] One caveat of this analysis is that it abstracts from potential reductions in the competition for targets. While such a reduction may be driven by the compliance costs and entail a decline in premiums, the total reduction in premiums would reflect both the direct effect of the compliance costs and the indirect effect through a reduction of competition.

[16] In the regressions that include year fixed effects, we drop the $S404$ dummy, as it is perfectly explained by a linear combination of the year dummies.

large firms hold less cash (relative to their assets) after the introduction of Section 404, whereas the hypothesis that Section 404 has had no effect on the cash holdings of small firms cannot be rejected.

## 3.6 Conclusion

In this paper, we have documented an unintended effect of Section 404 of the Sarbanes-Oxley Act: a weakening of the market for corporate control for small public US firms. Exempting nonaccelerated filers from compliance with Section 404 has made takeovers of such firms relatively more expensive for public US firms, as the acquirer inherits the responsibility for costly compliance if the public float of the merged companies exceeds the threshold of $75 million. This in turn has led to a decrease in the takeover threat stemming from public US acquirers faced by small companies after the legislation was passed and has become manifested in a decline of the takeover activity involving small public US companies. To the extent that a well-functioning takeover market helps to alleviate governance problems by imposing a removal threat on managers, this reduction in takeover activity implies that exempting small firms from compliance has had an unintended, negative effect on the corporate governance of these firms.

Furthermore, we have provided evidence that the passage of Section 404 has not only reduced the takeover threat faced by small public US firms, but has also had a negative effect on the premiums paid in the acquisitions of such firms. Finally, our results suggest that the reduced takeover threat might have allowed the managers of small firms to choose lower levels of leverage.

Table 3.1: Number of firms and takeovers

| Year | Small firms | Targets | % | Large firms | Targets | % |
|---|---|---|---|---|---|---|
| *Panel A: Acquisitions of Public US Firms by Public US Acquirers* | | | | | | |
| 2001 | 1,176 | 35 | 2.98% | 652 | 14 | 2.15% |
| 2002 | 1,142 | 20 | 1.75% | 638 | 14 | 2.19% |
| 2003 | 1,204 | 34 | 2.82% | 824 | 16 | 1.94% |
| 2004 | 1,026 | 25 | 2.44% | 782 | 15 | 1.92% |
| 2005 | 823 | 15 | 1.82% | 814 | 18 | 2.21% |
| 2006 | 699 | 11 | 1.57% | 877 | 21 | 2.39% |
| 2007 | 634 | 12 | 1.89% | 854 | 20 | 2.34% |
| *Panel B: Acquisitions of Public US Firms by Other Acquirers* | | | | | | |
| 2001 | 1,176 | 53 | 4.51% | 652 | 18 | 2.76% |
| 2002 | 1,142 | 21 | 1.84% | 638 | 9 | 1.41% |
| 2003 | 1,204 | 43 | 3.57% | 824 | 10 | 1.21% |
| 2004 | 1,026 | 19 | 1.85% | 782 | 21 | 2.69% |
| 2005 | 823 | 27 | 3.28% | 814 | 34 | 4.18% |
| 2006 | 699 | 24 | 3.43% | 877 | 37 | 4.22% |
| 2007 | 634 | 29 | 4.57% | 854 | 35 | 4.10% |

Table 3.2: Effect on takeover probabilities

The sample period is 2001 to 2007. *S*404 is a dummy that takes the value 1 for all years after 2003. *Small* is a dummy that takes the value 1 for small firms. Controls are ln(*mkt.cap.*), MtB, EBIT/assets, and CAPEX/assets. Industry fixed effects (Industry FE) are formed at the level of the first two digits of the SIC code. Standard errors (in parentheses) are clustered at the industry level. $^{***}$, $^{**}$, and $^{*}$ denote significance at the 1%, 5%, and 10% level.

| | Small firms | Large firms | All firms | All firms |
|---|---|---|---|---|
| Controls | yes | yes | yes | yes |
| Industry FE | yes | yes | yes | yes |
| Year FE | no | no | no | yes |
| N | 6,633 | 5,382 | 12,015 | 12,015 |
| *Panel A: Acquisitions of Public US Firms by Public US Acquirers* | | | | |
| $S404 \cdot Small$ | – | – | $-0.007^{*}$ | $-0.008^{*}$ |
| | | | (0.004) | (0.005) |
| $S404$ | $-0.006^{*}$ | 0.001 | 0.001 | – |
| | (0.003) | (0.003) | (0.003) | |
| *Small* | – | – | $0.012^{*}$ | $0.013^{*}$ |
| | | | (0.007) | (0.007) |
| $R^2$ | 0.015 | 0.008 | 0.009 | 0.010 |
| *Panel B: Acquisitions of Public US Firms by Other Acquirers* | | | | |
| $S404 \cdot Small$ | – | – | $-0.019^{*}$ | $-0.018$ |
| | | | (0.011) | (0.011) |
| $S404$ | 0.002 | $0.022^{***}$ | $0.022^{***}$ | – |
| | (0.007) | (0.006) | (0.006) | |
| *Small* | – | – | $0.014^{***}$ | $0.015^{***}$ |
| | | | (0.005) | (0.005) |
| $R^2$ | 0.016 | 0.021 | 0.014 | 0.017 |

Table 3.3: Effect on takeover premiums

The sample period is 2001 to 2007. All premiums have been winsorized at the 10% level. *S*404 is a dummy that takes the value 1 for all years after 2003. *Small* is a dummy that takes the value 1 for small firms. Controls are the toehold of the acquirer, the runup in the target's shareprice, a dummy for acquisitions within the same industry, the target's MtB ratio, CAPEX/assets, and cash/assets. Industry fixed effects are formed at the level of the first two digits of the SIC code. Standard errors (in parentheses) are clustered at the industry level. ***, **, and * denote significance at the 1%, 5%, and 10% level.

| | Small targets | Large targets | All targets | All targets |
|---|---|---|---|---|
| Controls | yes | yes | yes | yes |
| Industry FE | yes | yes | yes | yes |
| Year FE | no | no | no | yes |
| *Panel A: Acquisitions of Public US Firms by Public US Acquirers* | | | | |
| *S*404 · *Small* | – | – | −0.063* | −0.060* |
| | | | (0.036) | (0.035) |
| *S*404 | −0.078** | −0.015 | −0.001 | – |
| | (0.032) | (0.031) | (0.030) | |
| *Small* | – | – | 0.070** | 0.072** |
| | | | (0.028) | (0.028) |
| $R^2$ | 0.403 | 0.425 | 0.371 | 0.379 |
| N | 148 | 114 | 262 | 262 |
| *Panel B: Acquisitions of Public US Firms by Other Acquirers* | | | | |
| *S*404 · *Small* | – | – | 0.038 | 0.037 |
| | | | (0.044) | (0.039) |
| *S*404 | −0.008 | −0.041 | −0.054 | – |
| | (0.029) | (0.048) | (0.036) | |
| *Small* | – | – | 0.018 | 0.022 |
| | | | (0.032) | (0.024) |
| $R^2$ | 0.382 | 0.503 | 0.393 | 0.407 |
| N | 211 | 159 | 370 | 370 |

Table 3.4: Effect on leverage and cash holdings

The sample period is 2001 to 2007. *S*404 is a dummy that takes the value 1 for all years after 2003. *Small* is a dummy that takes the value 1 for small firms. *Leverage* is a firm's total long-term debt divided by its total assets. *Cash Holdings* is the firm's cash holdings divided by its total assets. Standard errors (in parentheses) are clustered at the firm level. $^{***}$, $^{**}$, and $^{*}$ denote significance at the 1%, 5%, and 10% level.

| | Small firms | Large firms | All firms | All firms |
|---|---|---|---|---|
| Firm FE | yes | yes | yes | yes |
| Year FE | no | no | no | yes |
| *Panel A: Effect on Leverage* | | | | |
| $S404 \cdot Small$ | – | – | $-0.035^{***}$ | $-0.034^{***}$ |
| | | | (0.010) | (0.010) |
| $S404$ | $-0.023^{***}$ | $0.015^{*}$ | $0.013^{*}$ | – |
| | (0.008) | (0.008) | (0.007) | |
| *Small* | – | – | $0.040^{***}$ | $0.040^{***}$ |
| | | | (0.007) | (0.007) |
| $R^2$ | 0.721 | 0.855 | 0.756 | 0.756 |
| N | 6,020 | 5,206 | 11,226 | 11,226 |
| *Panel B: Effect on Cash Holdings* | | | | |
| $S404 \cdot Small$ | – | – | $0.031^{***}$ | $0.028^{***}$ |
| | | | (0.007) | (0.008) |
| $S404$ | 0.003 | $-0.030^{***}$ | $-0.029^{***}$ | – |
| | (0.006) | (0.006) | (0.006) | |
| *Small* | – | – | $-0.008$ | $-0.006$ |
| | | | (0.007) | (0.008) |
| $R^2$ | 0.779 | 0.801 | 0.756 | 0.757 |
| N | 5,999 | 5,198 | 11,197 | 11,197 |

# Chapter 4

# Paying with Private Benefits

I thank Henri Servaes, Irem Tuna, and Paolo Volpin for helpful comments and suggestions. All remaining errors are my own.

## 4.1 Introduction

In many cases, those who own a business are not the ones that run it on a day to day basis—instead, the owner of a firm often resorts to hiring a manager. The resulting separation of ownership and control comes at a cost, if the owner's and the manager's interests diverge, and the actions to be taken by the manager cannot be contractually specified exhaustively. This might be the case, for example, if the owner does not know what actions should be taken in her best interest because she lacks the necessary experience or skills, or if the actions are not observable or verifiable in case of a dispute. This is where corporate governance comes into play. As Shleifer and Vishny (1997) note, "corporate governance deals with the ways in which suppliers of finance to corporations assure themselves of getting a return on their investment".

The reason why the suppliers of finance need to be worried about receiving a return on their investment in the first place, is that devoid of mechanisms that align both parties' interests, more often than not the actions preferred by the managers will not be the ones preferred by the firms' owners.[1] More specifically, a manager will maximize her rather than the owner's utility and choose her actions accordingly. This divergence of interests will arise especially under those circumstances, where certain actions that the manager might undertake give her access to private benefits that she cannot otherwise enjoy.

Private benefits can come in many different forms. If, for example, entering a new line of business gives rise to the opportunity to hire a relative of the manager as a consultant and if the manager derives some utility from such an arrangement, then entering the new line of business provides potential private benefits[2] to the agent. At the same time, hiring the manager's relative as a consultant most likely does not directly increase the utility of the firm's owners or of a different potential manager. Thus private benefits are valued by the manager directly, i.e., for what they are, but not by the firm's owner. The best the owner can hope for is to extract value indirectly through the agent, for example, by lowering the agent's salary.[3] Governance provisions are set in place to

[1] The suppliers of finance do not necessarily need to be the owners of the corporation—creditors are a point in case. Nonetheless, I abstract from the distinction between a firm's owners and the suppliers of finance and treat them as equal (or as sharing common interests at least). An extended analysis could include a second conflict of interest between a firm's owners and other suppliers of finance.

[2] I distinguish between *potentially available private benefits* and *private benefits*, because the benefits that are potentially available are not necessarily equal to those eventually realized.

[3] Note, that in this context, a benefit that the manager receives and that causes direct costs the firm's

alleviate the resulting conflict. Two main thrusts are incentive pay and monitoring. Incentive pay essentially rewards the agent for undertaking the actions preferred by the owners, whereas monitoring limits the amount of private benefits that can be extracted and thus makes taking an action that originally provides access to such private benefits less desirable.

In this paper, I will examine the joint determination of both types of mechanisms. Specifically, I will study the optimal mix of incentive pay and monitoring in the presence of private benefits in a simple principal-agent framework. Three main observations emerge from this analysis. First, the optimal level of monitoring, incentive pay, and the agent's expected total compensation are not monotone in the level of potentially available private benefits. For low levels and high levels of potential private benefits, it can be optimal not to monitor at all and to either resort entirely to incentive pay to induce the desired actions, or to allow the extraction of private benefits and internalize their value through a reduction in the manager's salary. Second, the principal's ability to monitor, i.e., to prevent the agent from enjoying the private benefits, increases overall efficiency. It can help to ameliorate the agency conflict and induce more efficient project selection. Third, the optimal mix of monitoring and incentive pay depends crucially on the agent's valuation of the potentially extractable private benefits. This has implications for empirical research, because the potentially available benefits might never be realized and are therefore difficult to observe. Furthermore, the valuation of the benefits might be highly subjective—after all, they are *private* benefits. Thus, considering agent specific factors might be crucial in an attempt to explain observed incentive and monitoring arrangements.

The paper falls into the intersection of several different lines of research. One studies the determinants of incentive pay and monitoring arrangements as measures of corporate governance, another the optimal provision of (private) benefits and perks, and a third related line of research examines the role of agent specific characteristics in economic settings. The simple model introduced in this paper draws on all three lines of research. Monitoring and incentive pay are used as governance provisions that target the agency problem between the firm's owner and the manager hired to run the firm, and—similar

owner (e.g., a large office) does not fall into the category of *private* benefits, but is a direct transfer from the owner to the manager. If the manager's valuation exceeds the direct costs incurred by the owner, than the "surplus", i.e., the difference between the valuation and the direct costs, could be interpreted as a private benefit.

to the findings of other models—the highest level of monitoring and incentive pay is not always optimal. Allowing the manager to extract some private benefits can be efficient. This result obtains even though the benefits are not productivity increasing and their direct costs might exceed their direct value. Furthermore, because the manager's subjective valuation of the potentially available private benefits plays an important role, the model suggests that manager specific characteristics might be a necessary ingredient in an attempt to understand observed corporate governance practices.

The rest of the paper is organized as follows. Section 4.2 briefly reviews the related literature. Section 4.3 introduces a simple model that relates the level of potentially available private benefits to the optimal incentive pay and monitoring arrangement. Section 4.4 discusses the empirical predictions that can be drawn from the model, and Section 4.5 concludes.

## 4.2 Review of related literature

With regards to monitoring arrangements and incentive schemes, the empirical literature is vast. Furthermore, several theory papers have examined the role of corporate boards and related their structure to the degree of monitoring that is conducted. A common result of the models developed in these papers is that the highest level of monitoring is not always optimal. Almazan and Suarez (2003), for example, explore how under certain conditions, shareholders find it optimal to relinquish some power to the CEO in order to save on the overall compensation costs. In their model, severance pay and weak boards are substitutes for incentive compensation, and corporate governance structures that involve some degree of entrenchment can be optimal. Adams and Ferreira (2007) examine the implications of the combined advising and monitoring roles of the board. The CEO faces a trade-off when sharing information with the board: on the one hand, the board will give better advice when the CEO shares information (which the CEO likes), but on the other hand, the more precise the board's information the greater is the risk to the CEO that the board will interfere in the decision making process of the firm (which the CEO dislikes). As a result, the CEO will not communicate information to a board that is too independent and therefore more prone to interfere. Thus, under the assumptions of the model it can be optimal to have a passive or more management-friendly board. Hermalin and Weisbach (1998) model the degree of the board's independence as the outcome of a bargaining game between the incumbent CEO and the existing directors over the CEO's compensation and who will fill arising vacancies on the board. Here, the CEO's bargaining power comes from his perceived ability and monitoring by the board serves the purpose of learning more about the CEO's ability. Finally, Raheja (2005) models the way in which combinations of insiders and outsiders affect the monitoring effectiveness of corporate boards. In this model, the board is responsible for monitoring projects and making CEO succession decisions, and insiders on the board compete for CEO succession. Insiders attempt to distinguish themselves from others by revealing private information to outside board members, and the optimal board structure is determined by the trade-off between maximizing the incentives for insiders to reveal their private information, minimizing the cost to outsiders to verify projects, and maximizing the outsiders' ability to reject inferior projects.

Concerning the optimal provision of perks and private benefits, Marino and Zabojnik (2008) incorporate perks in a principal-agent model to examine the relationship between the provision of work-related perks and formal incentives. The key assumption in their model is that there are consumption complementarities between perk consumption and effort. These complementarities have an incentive effect, which allows the principal to decrease the pay-performance sensitivity of the agent's explicit incentive contract, which in turn decreases the uncertainty in the agent's income. Given that the agent is risk averse, a lower income uncertainty translates into a lower expected pay that she must receive to accept the employment contract. This in turn increases the principal's expected profit. Similarly, Oyer (2008) analyses a firm's decision about the provision of benefits to its employees and develops a model in which firms choose to provide such benefits if they can do so more efficiently then the employees themselves. Additionally, he provides some empirical evidence in support of the model's predictions. Further empirical work on the role of perquisites includes Yermack (2006) and Rajan and Wulf (2006). Yermack (2006) focuses on the personal use of company planes by CEOs and finds no significant relationship between perquisites and compensation, ownership, or monitoring variables, but a significant influence of personal CEO characteristics such as long-distance golf club memberships. Moreover, he documents a negative relationship between the performance of a firm's shares and the disclosure of the CEO's personal aircraft use. Rajan and Wulf (2006) consider a broader range of perks that are offered to CEOs and divisional managers and do not find systematic evidence for the claim that perks are purely managerial excess and exemplify agency problems. To the contrary, they provide evidence that perks are used to enhance productivity.

Changing focus to the role of specific agents and their individual characteristics, Bertrand and Schoar (2003) investigate whether and how individual managers affect corporate decisions and performance. They find that manager fixed effects matter for a wide range of corporate decisions with respect to investment, financial, and organizational practices. Similarly, Graham, Li, and Qiu (2012) study the role of manager-specific heterogeneity in explaining executive compensation and find that time invariant manager fixed effects explain a significant fraction of the variation in executive pay.

## 4.3 A simple model

In this section, I will introduce a simple principal-agent model that is used to gain more insight into the relationship between private benefits, monitoring, and incentive pay. Consider a group of shareholders that own a company and employ a manager to run the company on their behalf. I will abstract from any conflicts of interests between the individual shareholders, between the manager and other employees of the firm, or between the firm and its suppliers or customers. Instead, I focus on the agency problem that arises in the relationship between the firm's owners and the manager. Thus, the situation can be condensed to a typical setup involving one principal (the shareholders) and one agent (the manager). The agent's only task is to perform an unobservable and non-verifiable action $a$ that influences the expected future profits $r$ of the firm, and she is compensated with a flat wage $w$ and a fraction $\beta$ of the realized future profits. Furthermore, the agent can enjoy private benefits $p$ that depend on the action she chooses as well as on the level of monitoring $m$ that is chosen by the principal.[4]

For simplicity, I make the following further assumptions. The principal is risk-neutral, and the agent is risk-averse with exponential utility over total compensation (wage, bonus, and private benefits), where $\gamma > 0$ is the agent's coefficient of absolute risk aversion. The agent has an outside option that provides utility $q > 0$, and her choice set contains only two possible actions, $a = 0$ and $a = 1$. The cost of effort that

[4] Note that in this setting monitoring cannot be used to directly force the agent to undertake a specific action, because any action is neither observable nor verifiable.

is born by the agent is $c(a) = a \cdot c$ for some $c > 0$. This setup can be interpreted as the choice between two mutually exclusive projects, where one of the projects is more cumbersome for the agent to implement, or as the choice of whether or not to exert effort for a given project. The firm's future profits are normally distributed with mean $\mu(a) = \underline{r} + a \cdot (\overline{r} - \underline{r})$ for some $\overline{r} - \underline{r} = \Delta > 0$ and variance $\sigma^2 > 0$. In the light of the earlier interpretation, this can be understood as one project ($a = 0$) having expected future profits $\underline{r}$ and the other one ($a = 1$) having future expected profits $\overline{r}$, or as the agent's effort increasing the expected profit for a given project from $\underline{r}$ to $\overline{r}$. In either case, the variance of the future profits is the same, i.e., both projects have the same risk or the agent's effort has no effect on the project's risk.

The principal's choice variables are the level of monitoring, $m = 0$ or $m = 1$, the fraction $\beta$ of the profits that is promised to the agent, and the flat wage $w$. All three variables are verifiable and specified in the contract between the principal and the agent. That is, the principal can commit to paying the agent a flat wage, imposing a certain level of monitoring, and paying a fraction of the project's profits to the agent once the profits have been realized. The cost of monitoring is $k(m) = m \cdot k$ for some $k > 0$, i.e., monitoring the agent ($m = 1$) costs the principal an amount $k$.

The private benefits the agent can enjoy are $p(a, m) = p \cdot (1 - a) \cdot (1 - m)$ for some $p > 0$. This specification can be interpreted as follows. If the agent chooses $a = 1$, i.e., if she chooses the more cumbersome project or to exert more effort, or if the principal chooses to monitor the agent ($m = 1$), then the agent is not able to extract any private benefits. If, on the other hand, the agent chooses $a = 0$ and if she is not monitored by the principal ($m = 0$), then the agent has access to private benefits $p$.[5] The role of monitoring is to "destroy the private benefits". If the principal chooses $m = 1$, then there are no private benefits for the agent to enjoy no matter her choice of $a$. In the context of the example provided in the introduction, monitoring could allow the firm's owner to prevent the manager from hiring her relative as a consultant irrespective of whether

[5] In this setup, the level of the potentially available private benefits is negatively correlated with the agent's effort or the choice of the more cumbersome project. Clearly, if this was not the case, both the agent and the principal would—ignoring the cost of effort $c$ for the moment—prefer $a = 1$ over $a = 0$, i.e., the private benefits would ameliorate the agency problem by working towards the alignment of both parties' interests. Note that this implies that private benefits are not "bad" per se, but only if they drive a wedge between what actions are preferred by the principal and what the agent prefers to do. If, for example, the agent derives private benefits from being perceived as highly successful (e.g., from winning a prestigious "agent of the year award"), then the principal might benefit if these private benefits induce the agent to exert more effort.

the firm enters into the new line of business or not. Finally, I assume a competitive labor market, so that under the optimal contract the agent's participation constraint will always be satisfied with equality.

The optimal contract $\{\beta^*, m^*, w^*\}$ that the principal will offer to the agent can be found by backward induction. For a given contract, the agent solves the optimization problem:

$$\max_{a\epsilon\{0,1\}} U^A = E\left[w + \beta r + p(m,a) - c(a)|\, a\right] - \frac{1}{2}\gamma V\left[w + \beta r + p(m,a) - c(a)|\, a\right],$$

where $U^A$ denotes the agent's utility, and $E[\cdot]$ and $V[\cdot]$ denote the expectation and variance operator, respectively. Thus, for given $\beta$, $m$, and $w$, the agent chooses $a = 1$ if[6]

$$w + \beta\overline{r} - c - \frac{1}{2}\gamma\sigma^2\beta^2 \geq w + \beta\underline{r} + p\cdot(1-m) - \frac{1}{2}\gamma\sigma^2\beta^2,$$

which simplifies to the incentive compatibility constraint

$$\beta \geq \frac{c + p(1-m)}{\Delta}.$$

Intuitively, the agent chooses to exert effort or to implement the more cumbersome project ($a = 1$), if the expected additional bonus payment $\beta\cdot\Delta$ is larger than the cost of effort $c$ and the loss of private benefits $p(1-m)$.

Furthermore, assuming a competitive labor market, the agent's participation constraint is

$$w + p(m,a) - c(a) + \beta E\left[r|\, a\right] - \frac{1}{2}\gamma\beta^2\sigma^2 \geq q.$$

Irrespective of the specific share of the flat wage, the bonus payment, and the private benefits, the agent's total compensation scheme always has to be such that the agent receives at least as much utility from working for the principal as she would receive from the outside option. Note, that the optimal contract $\{\beta^*, m^*, w^*\}$ will induce the agent to choose the optimal action $a = a^*$, and the participation constraint will hold with equality.

Taking the agent's incentive compatibility and participation constraint into account,

[6] I assume that if the agent is indifferent between two actions, she chooses the action preferred by the principal.

the principal solves the optimization problem

$$\begin{aligned}\max_{\beta,m\epsilon\{0,1\}} U^p &= E\left[r|\,a\right] - w - \beta E\left[r|\,a\right] - k\left(m\right)\\ \text{s.t. } a &= \begin{cases} 0 & \text{if} \quad \beta < \frac{c+p(1-m)}{\Delta} \\ 1 & \text{if} \quad \beta \geq \frac{c+p(1-m)}{\Delta} \end{cases}\\ \text{and } w &= q - p\left(m,a\right) + c\left(a\right) - \beta E\left[r|\,a\right] + \frac{1}{2}\gamma\beta^2\sigma^2,\end{aligned}$$

which simplifies to

$$\begin{aligned}\max_{\beta,m\epsilon\{0,1\}} U^p &= E\left[r|\,a\right] + p\left(m,a\right) - c\left(a\right) - k\left(m\right) - \frac{1}{2}\gamma\sigma^2\beta^2\\ \text{s.t. } a &= \begin{cases} 0 & \text{if} \quad \beta < \frac{c+p(1-m)}{\Delta} \\ 1 & \text{if} \quad \beta \geq \frac{c+p(1-m)}{\Delta} \end{cases}.\end{aligned}$$

As for the agent, $U^p$ denotes the principal's utility.

Note that the principal is effectively maximizing the total surplus that can be generated. Thus, the solution to the principal's problem is also the socially efficient solution. Furthermore, because the agent is risk-averse ($\gamma > 0$) and the project is risky $\left(\sigma^2 > 0\right)$, only $\beta = 0$ and $\beta = \frac{c+p(1-m)}{\Delta}$ are candidates for the optimal bonus scheme. If $a = 0$ is the desired outcome, $\beta = 0$ is optimal, and if $a = 1$ is the desired outcome, the optimal bonus arrangement is the one that just induces the agent to exert effort, i.e., $\beta = \frac{c+p(1-m)}{\Delta}$, without exposing the agent to any unnecessary risk. Thus, only four combinations of bonus schemes and monitoring arrangements need to be considered for the optimal contract: incentive pay and no monitoring, incentive pay and monitoring, no incentive pay and no monitoring, and monitoring and no incentive pay. The optimal wage $w^*$ can then be obtained by plugging the optimal bonus scheme $\beta^*$ and the optimal level of monitoring $m^*$ into the agent's participation constraint.

The principal's utility stemming from the four possible combinations of $\beta$ and $m$ is

$$U^p = \begin{cases} \overline{r} - c - \frac{1}{2}\gamma\left(\frac{c+p}{\Delta}\right)^2\sigma^2 - q & \text{for} \quad \left\{m = 0, \beta = \frac{c+p}{\Delta}\right\} \\ \overline{r} - c - k - \frac{1}{2}\gamma\left(\frac{c}{\Delta}\right)^2\sigma^2 - q & \text{for} \quad \left\{m = 1, \beta = \frac{c}{\Delta}\right\} \\ \underline{r} + p - q & \text{for} \quad \{m = 0, \beta = 0\} \\ \underline{r} - k - q & \text{for} \quad \{m = 1, \beta = 0\} \end{cases}$$

Clearly, the last combination, $\{m = 1, \beta = 0\}$, is never optimal, and pairwise comparisons of the principal's utility in the remaining three cases lead to the characterization of the optimal contract as a function of the potentially available private benefits.

In the following, I will assume that the expected additional profit $\Delta$ from switching from $a = 0$ to $a = 1$ is larger than the cost of effort $c$ and the loss of utility, $\frac{1}{2}\gamma\sigma^2\left(\frac{c}{\Delta}\right)^2$, due to exposing the agent to the least amount of income risk necessary to induce $a = 1$ in case there are no private benefits. This can be formalized as follows.

**Assumption A1:**

$$\Delta > c + \frac{1}{2}\gamma\sigma^2\left(\frac{c}{\Delta}\right)^2.$$

If assumption A1 is not satisfied, then clearly $a = 1$ cannot be efficiently induced irrespective of the level of private benefits. Furthermore, I will assume that the cost of monitoring $k$ is not so large that monitoring is never optimal. This is formalized as follows.

**Assumption A2:**

$$0 < k < k^*$$

*with*

$$k^* = \Delta - \frac{1}{2}\gamma\sigma^2\left(\frac{c}{\Delta}\right)^2 + \frac{\Delta^2}{\gamma\sigma^2} - \sqrt{\left(\frac{\Delta^2}{\gamma\sigma^2}\right)^2 + 2\frac{\Delta^2}{\gamma\sigma^2}\Delta}.$$

**Proposition 1:**

Under A1 and A2, the optimal contract is[7]

$$\begin{array}{ll} \left\{\beta^* = \frac{c+p}{\Delta}, m^* = 0, w^* = q + c - \frac{c+p}{\Delta}\overline{r} + \frac{1}{2}\gamma\sigma^2\left(\frac{c+p}{\Delta}\right)^2\right\} & \text{for} \quad 0 < p < p^* \\ \left\{\beta^* = \frac{c}{\Delta}, m^* = 1, w^* = q + c - \frac{c}{\Delta}\overline{r} + \frac{1}{2}\gamma\sigma^2\left(\frac{c}{\Delta}\right)^2\right\} & \text{for} \quad p^* < p < p^{**} \\ \{\beta^* = 0, m^* = 0, w^* = q - p\} & \text{for} \quad p^{**} < p \end{array}$$

*with*

$$p^* = -c + \sqrt{c^2 + \frac{2k\Delta^2}{\gamma\sigma^2}}$$

*and*

$$p^{**} = \Delta - c - k - \frac{1}{2}\gamma\left(\frac{c}{\Delta}\right)^2\sigma^2.$$

The case of $k > k^*$, i.e., if A2 is violated, is not particularly interesting, because moni-

[7] See the Appendix 4.A for a derivation.

toring is never optimal,[8] and the following discussion will focus only on the case where $0 < k < k^*$ holds.

First, note that the degree of monitoring, the bonus scheme, and the agent's expected total compensation are not monotone in the level of private benefits. For low levels of private benefits ($0 < p < p^*$), it is optimal not to monitor and to save the associated costs. Instead, incentive pay that increases in the level of potentially available private benefits is used to induce the agent to exert effort. Because increasing the agent's incentive compensation exposes her to risk, the total expected compensation ($w + \beta \cdot E[r]$) has to increase in $p$ as well in order to provide the agent with utility $q$. Thus, as the level of private benefits increases, incentivizing the agent to choose $a = 1$ becomes more and more costly. If $p$ exceeds the threshold $p^*$, it becomes optimal to monitor despite the costs $k$. The advantage of monitoring is that the bonus payment and therefore the agent's risk exposure can be reduced. If the private benefits are even larger ($p > p^{**}$), it is optimal not to monitor and to allow the agent to extract the private benefits. Exposing the agent to any income risk is not efficient in this case, so $\beta$ is set to 0, and the agent only receives a flat wage that covers the difference between the private benefits and her outside option. However, the chosen action will be $a = 0$. Note that this means that it can be optimal to let the agent enjoy some private benefits even if their direct value $p$ is smaller than their direct net costs $\Delta - c - k$, because by allowing the agent to extract the private benefits the principal can save the costs of exposing the agent to income risk, $\frac{1}{2}\gamma\left(\frac{c}{\Delta}\right)^2\sigma^2$, that are otherwise incurred.

The intuition behind these results is as follows. Low levels of private benefits are small disincentives for the agent to choose $a = 1$; rather than "destroying" these disincentives by means of monitoring at cost $k$, it is efficient to outweigh them with incentive pay. Intermediate levels of private benefits are costly to outweigh with incentive pay and more efficiently "monitored away". In both cases, the private benefits are not realized and

[8] Under A1 and

$$k^* < k$$

the optimal contract is

$$\begin{array}{ll} \left\{\beta^* = \frac{c+p}{\Delta}, m^* = 0, w^* = q + c - \frac{c+p}{\Delta}\overline{r} + \frac{1}{2}\gamma\sigma^2\left(\frac{c+p}{\Delta}\right)^2\right\} & \text{for} \quad 0 < p < \widehat{p} \\ \{\beta^* = 0, m^* = 0, w^* = q - p\} & \text{for} \quad \widehat{p} \leq p \end{array}$$

with

$$\widehat{p} = -\frac{\Delta^2}{\gamma\sigma^2} - c + \sqrt{\left(\frac{\Delta^2}{\gamma\sigma^2}\right)^2 + 2\frac{\Delta^2}{\gamma\sigma^2}\Delta}.$$

their value is lost. This is a price worth paying, because the gain in expected profits from high effort is sufficiently large. On the other hand, for high levels of private benefits, forsaking their value is not justified by the difference in expected profits. In this case, it is optimal for the principal to let the private benefits materialize and to internalize their value through an adjustment of the agent's wage.

The second observation is that the principal's ability to monitor, i.e., to prevent the agent from enjoying the private benefits, increases overall efficiency. In a first-best world, without any agency problems, $a = 1$ should be chosen if and only if $p < p^{FB}$ with $p^{FB} = \Delta - c$, i.e., if the increase in expected profits outweighs the cost of effort and the loss of private benefits. Clearly, this rule cannot be implemented under the assumptions of the model. With incentive pay only and without resorting to monitoring, $a = 1$ will be implemented if and only if $p < \widehat{p} < p^{FB}$ with $\widehat{p} = -\frac{\Delta^2}{\gamma\sigma^2} - c + \sqrt{\left(\frac{\Delta^2}{\gamma\sigma^2}\right)^2 + 2\frac{\Delta^2}{\gamma\sigma^2}\Delta}$. Thus, for private private benefits larger than $\widehat{p}$ but smaller than $p^{FB}$, $a = 1$ cannot be implemented even though it is socially desirable. If the principal can implement monitoring arrangements in addition to incentive pay, $a = 1$ will be implemented if and only if $p < p^{**} < p^{FB}$. This is achieved by setting $\beta^* = \frac{c+p}{\Delta}$ and $m^* = 0$ for $0 < p < p^*$, and $\beta^* = \frac{c}{\Delta}$ and $m^* = 1$ for $p^* < p < p^{**}$. Because $\widehat{p} < p^{**}$, this leads to an efficiency improvement in the cases were $p$ is larger than $\widehat{p}$, but smaller than $p^{**}$. Intuitively, monitoring can improve efficiency, because it can remove the private benefits that cause part of the agency problem. Nonetheless, because $p^{**} < p^{FB}$, there remains a region between $p^{**}$ and $p^{FB}$ in which $a = 1$ is efficient, but cannot be implemented. With regards to the relationship between the total social surplus and the level of private benefits, for $0 < p < p^*$ the total social surplus decreases in $p$, for $p^* < p < p^{**}$ it is independent of $p$, and for $p^{**} < p$ it increases in $p$.

## 4.4 Empirical predictions

In the simple model introduced in the previous section, the optimal level of monitoring and incentive pay and the agent's expected total monetary compensation are not monotone in the level of potentially available private benefits. Moreover, it can be optimal to allow the extraction of some benefits, even if they are not productivity enhancing and if their direct costs exceed their direct value. These results call for a cautious interpretation of observed empirical relationships as evidence for or against well functioning governance arrangements. Low monitoring in combination with high pay or the extraction of private benefits does not necessarily suggest that governance is failing.

Furthermore, what matters ultimately is the agent's individual valuation of the private benefits. From an empirical point of view, this means that it is to be expected that the level of potentially available private benefits is not only determined by firm, industry, and country characteristics, but also by characteristics of the agent herself. After all, the benefits are private—they can be directly enjoyed only by the agent. Complicating matters further, the potentially available private benefits might never be realized and are therefore difficult to observe.

Nonetheless, some broad empirical predictions can be derived from the model. First, low levels of monitoring should be observed for low and for high levels of potential private benefits, and high levels of monitoring should be observed for intermediate levels of potential private benefits. Second, incentive pay should increase with the level of potential private benefits as long as they are low. For intermediate levels of private benefits, incentive pay that is combined with monitoring should be lower than in cases with low levels of potential private benefits. If potential private benefits are high, incentive pay should be lowest. The same pattern applies to the relationship between total expected monetary compensation and potential private benefits. Third, the extraction of some private benefits should be observed, even if they are not productivity enhancing and their direct costs exceed their direct value. Last but not least, the model implies that even after controlling for observable firm, industry, and country characteristics, the governance provisions in place should vary with different agents and their specific characteristics.

Several routes might be considered to study these empirical implications. First, the level of investor protection in different countries might allow to proxy for the level of potentially available private benefits in these countries. In this context, high levels of investor protection would imply low levels of potential private benefits and should be associated with low levels of monitoring and high levels of incentive pay. Low levels of investor protection would imply high levels of potential private benefits and accordingly be associated with low levels of monitoring and incentive pay. Finally, the combination of high levels of monitoring and incentive pay should be expected in cases of intermediate levels of investor protection. Evidence that the level of private benefits is influenced by the level of investor protection and varies significantly between countries is provided, for example, by Dyck and Zingales (2004) and Nenova (2003), who estimate the private benefits of control across different countries using data on controlling blocks sales and dual-class firms, respectively.

Second, because the level of potential private benefits and especially their valuation is unlikely to be determined entirely by the level of investor protection, industry, and firm characteristics, a potential avenue for future research might be to study the relationship between individual managers and the governance arrangements of the companies by which they are employed. Such research might be conducted in a fashion similar to the approaches taken by Bertrand and Schoar (2003) or Graham, Li, and Qiu (2012): CEO-fixed effects that go beyond ability and are related to the value of potential private benefits might have a role in explaining observed compensation and monitoring schemes.

## 4.5 Conclusion

In this paper, I have argued that private benefits play an important, dual role in the determination of optimal monitoring and incentive schemes. On the one hand, private benefits deter managers from taking the actions preferred by the firms' owners, but on the other hand, private benefits are valuable to the managers and can thus be made part of their total compensation and lower the managers' income risk.

Three main observations have been derived in a simple principal-agent setup. First, the optimal level of monitoring, the optimal incentive scheme, and the agent's expected total compensation are not monotone in the level of potentially available private benefits. Private benefits are not always a bad thing and allowing their extraction can be optimal. Second, the principal's ability to monitor, i.e., to prevent the agent from enjoying the private benefits, increases overall efficiency. Third, the optimal mix of monitoring and incentive pay depends crucially on the agent's subjective valuation of the potentially extractable private benefits—benefits that might never materialize. The last point has several implications for empirical research. Without considering agent-specific factors, observed corporate governance arrangements might be difficult to interpret. On the other hand, studying the impact of individual managers on the corporate governance practices of the firms by which they are employed offers many opportunities for future empirical research.

## Appendix 4.A: Derivation of proposition 1

Proposition 1 is derived from pairwise comparisons of the principal's utilities that arise from the four possible combinations of monitoring intensities and bonus schemes. Numbering the cases from 1 to 4, we obtain

$$\begin{array}{llll} (1) & U^P_{(1)} = \overline{r} - c - \frac{1}{2}\gamma\left(\frac{c+p}{\Delta}\right)^2\sigma^2 - q & \text{for} & \left\{m=0, \beta = \frac{c+p}{\Delta}\right\} \\ (2) & U^P_{(2)} = \overline{r} - c - k - \frac{1}{2}\gamma\left(\frac{c}{\Delta}\right)^2\sigma^2 - q & \text{for} & \left\{m=1, \beta = \frac{c}{\Delta}\right\} \\ (3) & U^P_{(3)} = \underline{r} + p - q & \text{for} & \{m=0, \beta=0\} \\ (4) & U^P_{(4)} = \underline{r} - k - q & \text{for} & \{m=1, \beta=0\}. \end{array}$$

Clearly, the fourth combination $\{m = 1, \beta = 0\}$ is never optimal. Intuitively, if the agent does not receive a bonus payment ($\beta = 0$), she has no incentives to exert effort, and will always choose $a = 0$. In this case, monitoring does not change the agent's choice and only leads to additional costs $k$ as well as the loss of the private benefits $p$. This leaves three comparisons: $(i)$ $U^P_{(1)}$ versus $U^P_{(2)}$, $(ii)$ $U^P_{(1)}$ versus $U^P_{(3)}$, and $(iii)$ $U^P_{(2)}$ versus $U^P_{(3)}$. The following results are obtained through simple algebra.

$(i)$ $U^P_{(1)} > U^P_{(2)}$ if and only if

$$\overline{r} - c - \frac{1}{2}\gamma\left(\frac{c+p}{\Delta}\right)^2\sigma^2 > \overline{r} - c - k - \frac{1}{2}\gamma\left(\frac{c}{\Delta}\right)^2\sigma^2,$$

which simplifies to

$$p^2 + p2c - \frac{2k\Delta^2}{\gamma\sigma^2} < 0.$$

Thus, $U^P_{(1)} > U^P_{(2)}$ for $0 \le p < p^*$ with $p^* = -c + \sqrt{c^2 + \frac{2k\Delta^2}{\gamma\sigma^2}}$.
Denote $0 \le p < p^*$ as condition C1.

$(ii)$ $U^P_{(1)} > U^P_{(3)}$ if and only if

$$\overline{r} - c - \frac{1}{2}\gamma\left(\frac{c+p}{\Delta}\right)^2\sigma^2 > \underline{r} + p$$

which simplifies to

$$p^2 + 2p\left(\frac{\Delta^2}{\gamma\sigma^2} + c\right) - \left[2\frac{\Delta^2}{\gamma\sigma^2}(\Delta - c) - c^2\right] < 0.$$

Thus, under A1 $\left(\Delta > c + \frac{1}{2}\gamma\sigma^2\left(\frac{c}{\Delta}\right)^2\right)$, $U^P_{(1)} > U^P_{(3)}$ for $0 \leq p < \widehat{p}$ with

$$\widehat{p} = -\frac{\Delta^2}{\gamma\sigma^2} - c + \sqrt{\left(\frac{\Delta^2}{\gamma\sigma^2}\right)^2 + 2\frac{\Delta^2}{\gamma\sigma^2}\Delta}.$$

Denote $0 \leq p < \widehat{p}$ as condition C2.

$(iii)$ $U^P_{(2)} > U^P_{(3)}$ if and only if

$$\overline{r} - c - k - \frac{1}{2}\gamma\left(\frac{c}{\Delta}\right)^2\sigma^2 > \underline{r} + p.$$

Thus, assuming $\Delta - c > \frac{1}{2}\gamma\sigma^2\left(\frac{c}{\Delta}\right)^2 + k$, $U^P_{(2)} > U^P_{(3)}$ for $0 \leq p < p^{**}$ with

$$p^{**} = \Delta - c - k - \frac{1}{2}\gamma\sigma^2\left(\frac{c}{\Delta}\right)^2.$$

Denote $0 \leq p < p^{**}$ as condition C3.

Comparing $p^{**}$, $p^*$, and $\widehat{p}$, the following conditions obtain.

$\widehat{p} > p^*$ if and only if

$$-\frac{\Delta^2}{\gamma\sigma^2} - c + \sqrt{\left(\frac{\Delta^2}{\gamma\sigma^2}\right)^2 + 2\frac{\Delta^2}{\gamma\sigma^2}\Delta} > -c + \sqrt{c^2 + \frac{2k\Delta^2}{\gamma\sigma^2}}$$

which simplifies to

$$k < \Delta + \frac{\Delta^2}{\gamma\sigma^2} - \frac{1}{2}\gamma\sigma^2\left(\frac{c}{\Delta}\right)^2 - \sqrt{\left(\frac{\Delta^2}{\gamma\sigma^2}\right)^2 + 2\frac{\Delta^2}{\gamma\sigma^2}\Delta}.$$

$p^{**} > \widehat{p}$ if and only if

$$\Delta - c - k - \frac{1}{2}\gamma\left(\frac{c}{\Delta}\right)^2\sigma^2 > -\frac{\Delta^2}{\gamma\sigma^2} - c + \sqrt{\left(\frac{\Delta^2}{\gamma\sigma^2}\right)^2 + 2\frac{\Delta^2}{\gamma\sigma^2}\Delta}$$

which simplifies to

$$k < \Delta + \frac{\Delta^2}{\gamma\sigma^2} - \frac{1}{2}\gamma\sigma^2\left(\frac{c}{\Delta}\right)^2 - \sqrt{\left(\frac{\Delta^2}{\gamma\sigma^2}\right)^2 + 2\frac{\Delta^2}{\gamma\sigma^2}\Delta}.$$

Thus, if $k < k^*$ with $k^* = \Delta + \frac{\Delta^2}{\gamma\sigma^2} - \frac{1}{2}\gamma\sigma^2\left(\frac{c}{\Delta}\right)^2 - \sqrt{\left(\frac{\Delta^2}{\gamma\sigma^2}\right)^2 + 2\frac{\Delta^2}{\gamma\sigma^2}\Delta}$, then we have $p^{**} > \widehat{p} > p^*$. Note that $0 < k < k^*$ is assumption A2.

Furthermore, note that

$$\Delta - c - \frac{1}{2}\gamma\sigma^2\left(\frac{c}{\Delta}\right)^2 > \underbrace{\Delta + \frac{\Delta^2}{\gamma\sigma^2} - \frac{1}{2}\gamma\sigma^2\left(\frac{c}{\Delta}\right)^2 - \sqrt{\left(\frac{\Delta^2}{\gamma\sigma^2}\right)^2 + 2\frac{\Delta^2}{\gamma\sigma^2}\Delta}}_{k^*}$$

simplifies to

$$\Delta > c + \frac{1}{2}\gamma\sigma^2\left(\frac{c}{\Delta}\right)^2.$$

Thus, under A1 $\left(\Delta > c + \frac{1}{2}\gamma\sigma^2\left(\frac{c}{\Delta}\right)^2\right)$, $k < k^*$ also implies $\Delta - c > \frac{1}{2}\gamma\sigma^2\left(\frac{c}{\Delta}\right)^2 + k$, the condition needed to derive that $U^P_{(2)} > U^P_{(3)}$ for $0 \leq p < p^{**}$.

In summary, under A1 and A2, the following relationships are implied by C1, C2, and C3:

$$\begin{array}{lll} U^P_{(1)} > U^P_{(2)} > U^P_{(3)} & \text{for} & 0 \leq p < p^* \\ U^P_{(2)} > U^P_{(1)} > U^P_{(3)} & \text{for} & p^* < p < \widehat{p} \\ U^P_{(2)} > U^P_{(3)} > U^P_{(1)} & \text{for} & \widehat{p} < p < p^{**} \\ U^P_{(3)} > U^P_{(2)} > U^P_{(1)} & \text{for} & p^{**} < p. \end{array}$$

If to the contrary, A2 is violated while A1 is still satisfied, then $p^{**} < \widehat{p} < p^*$ obtains. Together with C1, C2, and C3, this implies:

$$\begin{array}{lll} U^P_{(1)} > \max\left\{U^P_{(2)}, U^P_{(3)}\right\} & \text{for} & 0 \leq p < \widehat{p} \\ U^P_{(3)} > \max\left\{U^P_{(2)}, U^P_{(3)}\right\} & \text{for} & \widehat{p} < p. \end{array}$$

This pins down the optimal contract under A1.

# Chapter 5

# Conclusion

In this thesis, I have presented research on executive compensation and corporate governance. The first chapter provided a brief introduction. The second chapter examined the interplay between managerial optimism and compensation. A two period principal-agent model was introduced to study the effect of an agent's optimism on the optimal compensation contract. Furthermore, empirical evidence was presented showing that CEOs whose behavior is indicative of optimistic beliefs receive lower incentive and total pay than their peers. In the third chapter, an unintended effect of the Sarbanes-Oxley Act on the market for corporate control was documented. In particular, empirical evidence was presented suggesting that exempting small public US firms from compliance with Section 404 has lowered the takeover activity involving such firms and led to a reduction in the takeover premiums that were paid in the acquisitions. In the fourth chapter, I have examined the role of private benefits in optimal compensation and monitoring arrangements. Using a simple principal-agent framework, it was shown that it may be optimal to allow the extraction of private benefits even if they are not productivity enhancing and if their direct costs exceed their direct value.

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