CEO Power, Compensation, and Governance*

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Abstract

This paper presents a contracting model of governance based on the premise that CEOs are the main promoters of governance change. CEOs use their power to extract higher pay or private benefits, and different governance structures are preferred by different CEOs as they favor one or the other type of compensation. The model explains why good country-wide investor protection breeds good firm governance and predicts a "race to the top" in firm-governance quality after the Sarbanes-Oxley Act. However, such governance changes may be associated with higher rather than lower CEO pay as CEOs substitute away from private benefits. The model also provides an explanation for the observed correlation of CEO pay and firm governance as driven by CEO power.

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1 Introduction

The scope for CEO power in public corporations is vast. One view is that powerful CEOs influence the board of directors into paying them a high compensation preferably with little or no strings attached (Bebchuk et al. (2002)). Another view argues that powerful CEOs engage in changing the very governance that monitors and evaluates their actions (e.g. Hermalin and Weisbach (1998) and Hellwig (2000)). Accordingly, the rules of the game by which management is compensated and incentives are granted are not static and are themselves subject to change by management. This paper analyzes how CEO power affects the choice of CEO pay and the design of firm governance. We also ask how changes in the external governance environment, like the Sarbanes-Oxley Act of 2002 (SOX), affect incentives in exercising CEO power and internal governance.

We present a simple contracting model of governance based on the premise that CEOs are the main promoters of governance change. In the model, CEO power can be used to extract formal pay and private benefits from the firm. Extraction of private benefits is costly to the CEO for two reasons. First, if the CEO is monitored and caught diverting firm resources he has to return the diverted income and pay a deadweight fee. Second, because of this risk, private-benefits extraction increases the volatility of the CEO's consumption, which is costly for a risk averse CEO. In spite of these costs, positive private benefits occur because they are nonverifiable by the firm's shareholders and because monitoring of the CEO may not be successful, giving rise to a moral hazard problem. Moreover, to make it easier to extract private benefits, CEOs may spend effort changing the monitoring intensity of the shareholders, interpreted here as changing governance. In an optimal contract, shareholders may allow the change in governance and increased diversion in exchange for offering a low wage.

Our main result is that good external governance breeds good internal governance. This result is consistent with empirical evidence. For example, in the wake of SOX, Coca-Cola Co., the Washington Post Co., Bank One, General Electric, General Motors and Procter & Gamble all announced that they would voluntarily start expensing executive stock options, long before in 2004 the Financial Accounting Standards Board presented a draft of its accounting standard on options expensing, SFAS 123(R).[1] Studying the impact of SOX on corporate boards, Linck

[1] FASB published in Dec/2004 FASB Statement No. 123 (revised 2004), *Share-Based Payment*. The statement

et al. (2009) document that post-SOX fewer directors are current executives and more directors are lawyers, consultants or financial experts, and that audit committees doubled the number of meetings. This evidence suggests that a "race to the top" was initiated at the time of the enactment of SOX. In addition, Durnev and Kim (2005) and Klapper and Love (2004) find that external governance, as measured by indices of anti-director rights or the rule-of-law, is positively associated with internal governance, as measured by various firm-level transparency and accountability variables.

The evidence that good external governance breeds good internal governance is puzzling in light of the implicit view in the literature that external governance acts as a substitute for internal governance. This view is influenced by the observation in La Porta et al. (1998, 2000) of a negative correlation of shareholder ownership and country-wide investor protection, as well as by the theories that argue that external finance and the market for corporate control can act as a disciplining device in the absence of good firm governance (e.g. Jensen (1986), Shleifer and Vishny (1997)). However, Franks and Mayer's (2001) finding of an active market in share blocks in Germany together with the exploitation of private benefits of control suggests against the substitution hypothesis.

Importantly, we derive our result that good external governance *complements* good internal governance, even though these instruments can be *substitutes* in limiting diversion: under substitutability, the higher the monitoring intensity, the lower the effectiveness of the deadweight fee in limiting diversion and thus more of one should reduce the need for the other and vice-versa. The intuition for our result is the following: With preferences that exhibit decreasing absolute risk aversion, *high-powered CEOs*, which get paid more, become less risk averse and take greater gambles in diverting output. This increases incentives to worsen internal governance and to divert even more output.[2] When external governance improves, the perverse incentive effect of CEO pay is weakened. It is then possible for firms to give more formal pay to a CEO without unduly generating incentives to change governance, resulting in better overall

requires that the fair-value compensation cost relating to share-based payment transactions be recognized in financial statements and was to be implemented by public entities (other than those filing as small business issuers) as of the first interim or annual reporting period that began after June 15, 2005. But already in April 1, 2004, *Business Week*'s article "Expensing Options: An Overblown Storm" reported: "Some 500 publicly traded companies have already started expensing options, or said they will."

[2] Evidence consistent with CEOs' preferences displaying decreasing absolute risk aversion can be found in Becker (2006). Johnson et al. (2009) show that managers at fraud firms receive more total pay than executives at industry-size matched control firms.

firm-level governance. This mechanism applies when the level of risk aversion is low.

For CEOs with high risk aversion, the utility cost associated with consumption volatility is so high that they prefer more monitoring to less, acting as a commitment device not to divert income. Therefore, they are unwilling to gamble in diverting output. It is the *low-powered CEOs* that receive too little formal pay that choose to weaken governance. These CEOs value the increase in expected consumption from the extra dollar of private benefits more than the associated increase in consumption volatility. When external governance improves not only expected consumption decreases but also consumption volatility increases when diverting output. Therefore, fewer of low-powered CEOs choose to weaken governance.

Better external governance does not imply lower CEO pay. Indeed, the model predicts that CEO pay may increase as a result of SOX if CEO power is unaffected with the governance changes: firms substitute away from costlier private benefits and into formal pay when compensating CEOs. This increase in CEO pay is independent of any pay increase that might be justified by the higher certification costs implied by SOX.[3]

The model also predicts a negative relationship between internal governance and CEO pay for CEOs with low risk aversion. This negative relationship is consistent with the empirical finding in Core et al. (1999), now widely documented in the CEO compensation literature, that CEO pay is higher in firms with weaker governance, controlling for common pay factors. In our paper this association is driven by cross-sectional variation in CEO power. Direct evidence in favor of our mechanism is given in Malmendier and Tate (2009). They find that CEOs that receive prestigious awards from the business press, which presumably increase their power, are able to extract more compensation while their firms display more earnings management after the award. Their analysis attributes these effects to CEO power unrelated to CEO ability, because they use a control sample of successful CEOs that did not get any press award.

Ours is not the first explanation for the positive association between country-wide and firm-level governance. La Porta et. al (1998) (LLSV) claim that as a legal matter it may be costly for firms to opt out of existing legal rules, because courts may not be knowledgeable or willing to enforce such contracts (this view stands in contrast with Easterbrook and Fischel (1996)). Durnev and Kim (2005) predict a negative relationship between external governance and the

[3] For example, "Special Report: CEO pay 'business as usual'," in *USA Today*, March 2005.

dollar value of diversion, which they interpret as inducing a positive association between the quality of external and internal governance. However, changing the dollar value of diversion does not necessarily guarantee that internal governance laws would be changed as we demonstrate in the paper. Sansing and Stocken (2006) predict that after SOX, firms should choose to have more active boards as these can better reduce the expected costs of noncompliance with Section 404 of the Act. They focus on the role of industry competition, whereas we focus on the role of CEO power and the interaction of governance with CEO pay.

In a seminal paper, Hermalin and Weisbach (1998) develop a theory of governance (i.e., boards) recognizing that the process is influenced by CEOs. In their setting CEO power is determined by the CEO's perceived ability relative to potential successors. Among other things, they predict that CEOs use their power to reduce scrutiny from the board and increase their pay. Therefore, as in this paper, cross-sectional variation in CEO power can explain the evidence in Core et al. (1999). Hermalin and Weisbach (2006) conduct a complementary analysis to ours by focusing on the welfare implications of governance reform. As in our paper, they argue that governance structures arise endogenously in response to the constrained optimization problems faced by the relevant parties. Unlike our paper that studies a moral hazard problem, they extend Hermalin and Weisbach (1998) and Hermalin's (2005) career concern model.[4]

The remainder of the paper proceeds as follows. In the next section we present our basic framework. Section 3 presents the solution of the model and Section 4 discusses its properties relating to CEO power, CEO pay and governance. Section 5 concludes. The appendix contains the proofs to the main results in the text.

2 The model

We assume in our model that there is no agency conflict between the board of directors and shareholders. We thus refer to them interchangeably. Instead, we focus on the agency conflict

[4] There are other papers that, like ours, focus on the ability of CEOs to affect the monitoring mechanism that governs their actions. Burkart et al. (1997) highlight the fact that too much CEO monitoring can reduce managerial initiative. In a model of severance pay and separations, Almazan and Suarez (2003) develop a model in which shareholders find it sometimes optimal to reduce the monitoring of the CEO in order to economize on CEO compensation. Adams and Ferreira (2007) and Harris and Raviv (2008) examine the dual role of boards, to monitor and to advise management. In order to give advice the board needs the information from the CEO, but can also use this information to increase monitoring. Dow and Raposo (2005) model CEOs who can influence their own pay by changing corporate strategies. Fluck and Mayer (2007) discuss the impact of allocation of control rights and the choice of reincorporation and governance structures.

between shareholders and the CEO to show that adverse changes in governance can occur, and be optimal from the shareholders' perspective, even when boards act on their fiduciary obligations toward shareholders. We argue that in the presence of imperfect investor protection and nonverifiability of effort to change governance, the CEO has an incentive to spend effort influencing the board toward weaker governance.

2.1 Setup

The firm together with the CEO generate a constant output level y. The CEO can divert resources of dy, where the fraction d is chosen by the CEO, resulting in a level of net output equal to $y\,(1-d)$.

The monitoring mechanism. As in Shleifer and Wolfenzon (2002), we assume that diversion is observable though non-verifiable unless monitoring is successful. If monitoring is successful, the CEO has to return the diverted output dy. We also assume that the CEO faces a punishment for diverting output which constitutes a deadweight loss as it does not accrue to the firm. We model this punishment as a proportion of diverted output ηdy, where $\eta > 0$. That is, the more the CEO diverts the more severe is the punishment. This punishment captures loss of reputation and opportunity cost of jail time. The assumption of proportional fines simplifies our analysis.

We let the firm's internal monitoring mechanism be endogenous and subject to change by the CEO albeit with the approval of the board of directors. The change in monitoring effectiveness promoted by the CEO depends on his effort $a \in \{H, L\}$, where $a = L$ means that the CEO exerts low effort to change the firm's internal monitoring and the status quo is maintained, and $a = H$ means that the CEO exerts high effort to change monitoring effectiveness. With low effort, the probability that monitoring is successful is p_L. Incurring high effort entails an effort cost of k, but allows the CEO to face a lower probability of being successfully monitored $p_H < p_L$. Appointing CEO-friendly boards as in Hermalin and Weisbach (1998) constitutes one way of reaching p_H (see also subsection 2.2). We assume equal monitoring costs paid by the firm for both high and low monitoring intensities. This assumption gears the results toward fewer firms wanting to pursue weaker governance, because in reality we expect that more monitoring is also costlier. Without loss of generality, we take these costs to be zero.

We assume that CEO effort is nonverifiable.[5] This non-verifiability generates a moral hazard problem between the CEO and the board of directors. We return to the issue of nonverifiability of CEO effort in subsection 2.2 below. Our goal is to study the optimal contract under this moral hazard problem.

Our model setup is related to that in Shleifer and Wolfenzon (2002). In Shleifer and Wolfenzon, p_a is interpreted as a corporate governance mechanism exogenous to the firm and common across all firms. Likewise, the penalty imposed to the CEO η is also exogenous to the firm and common across all firms. Therefore, in their setting governance is dictated by country-wide regulations in the spirit of La Porta et al. (1998). In our model, the CEO can influence the board of directors to change the firm's charter. We therefore interpret the probability p_a $(a = H, L)$ of monitoring being successful as a measure of internal governance and η as a measure of external governance. The latter is determined, for example, by country law and the quality of the judicial system. Under this interpretation, in the model, actions pursued within the country's (exogenous) legal system against the CEO as represented by η are triggered by the internal (endogenous) monitoring of the CEO by the board as represented by p_a.[6]

Arguably, η could also be interpreted as internal disciplinary actions taken by the board against the CEO, including dismissal of the CEO, but in our view the likely bigger cost for the CEO comes from stakeholders prosecuting irregularities in a court of law. We model the effort cost k so that it does not impact diversion income at the margin. Therefore, a reasonable interpretation of the effort cost is the amount of political capital lost in changing governance which could depend on CEO skill, or lack thereof, in influencing other people.

CEO compensation. The board and the CEO agree on an employment contract which specifies a compensation, or wage pair $(w, \tilde{w})$ to the CEO. The wage w is paid if monitoring is unsuccessful and the wage $\tilde{w}$ is paid if monitoring is successful. Alternatively, we may interpret the wage w as the fixed wage paid before monitoring takes place and interpret $w - \tilde{w} > 0$

[5] A similar assumption is common in the tax evasion literature, e.g. Allingham and Sandmo (1972) and Yitzhaki (1974).

[6] It is possible that country law also determines a mean level $\bar{p}$ of monitoring. Our view is that firms would have some degree of flexibility of opting out or increasing monitoring relative to $\bar{p}$, therefore leading to their own chosen values of p_L or p_H (see Easterbrook and Fischel (1996) on this flexibility). Moreover, some external monitoring may also occur. For example, in the US the Securities and Exchange Commission engages in substantial monitoring. This external monitoring can be modeled as a lower bound on p_L.

as a penalty if monitoring is successful. We look for an optimal contract within a class of contracts where the pair $(w, \tilde{w})$ satisfies $\tilde{w} = w - d_a y$. That is, we assume that if monitoring is successful, the CEO is forced to return the diverted output. We will discuss the contract form in subsection 2.2 below. Note that the penalty $\eta d_a y$ does not enter here as it is exogenous to the firm and the CEO.

CEO preferences and CEO power. CEOs are risk averse with utility function $u(a, c) = c^{1-\gamma}/(1-\gamma) - g(a)$, where $\gamma \neq 1$ is the level of relative risk aversion, c is consumption, and $g(a) = k$ if $a = H$ and $g(a) = 0$ if $a = L$.[7] Because CEOs are assumed to have zero wealth and the marginal utility of zero consumption is infinity, limited liability of the CEO is implicitly guaranteed in any employment contract. The zero CEO wealth assumption also rules out the trivial case where the CEO buys the firm and agency conflicts disappear.

CEO power is given by his reservation utility V: a CEO with power V only accepts a contract if by doing so he attains at least utility V. This assumption is implied also in models with Nash bargaining as in Hermalin and Weisbach (1998). We may assume $V = \underline{c}^{1-\gamma}/(1-\gamma)$ for some reservation consumption $\underline{c} > 0$, implying that $V < 0$ for $\gamma > 1$ and $V > 0$ for $\gamma < 1$. We take CEO power as exogenous while acknowledging that CEO power is likely to depend on various CEO, firm and labor-market characteristics. For example, the CEO's ability to change output, or his ability to change governance (through his charisma, smooth talk, education pedigree), and the CEO's risk aversion are all CEO traits that determine CEO power. Similarly, the level of internal governance, p_a, and the extent of feasible governance changes, $p_L - p_H$, are firm characteristics that help determine CEO power. Endogenizing CEO power is an interesting research avenue that is outside the scope of this paper.

Model timeline. The timeline for the contract is described by the following stages (see Figure 1):

Stage 1. The board offers contract $(w, \tilde{w})$.

Stage 2. The CEO accepts or rejects the offer. If he accepts, the CEO extracts at least V from the firm. The next stage starts. Otherwise, the game is over.

[7] We treat the knife-edge, log-case of $\gamma = 1$ in the appendix. This case is uninteresting as CEO power does not change incentives to change governance.

Stage 3. The CEO chooses effort a regarding whether or not to change monitoring.

Stage 4. The CEO chooses the amount of diversion $d_a y$.

Stage 5. Reported net output $y - d_a y$ is realized and the CEO is paid w. If monitoring is successful, the board can verify diversion $d_a y$ and the CEO is forced to return $d_a y = w - \tilde{w}$. Otherwise, the CEO keeps the wage w.

[Figure 1 here.]

Note that in our model the moral hazard problem arises because the CEO may exert nonverifiable effort to change the monitoring intensity. We do not consider the moral hazard problem in the production stage, which is often studied in the standard textbook moral hazard model. For this reason and because y is constant, w will not depend on y in the optimal contract.

Shareholders' problem. Shareholders, and the board of directors acting on their behalf, are risk neutral and maximize expected profits. Shareholders choose the firm's corporate charter and any governance structure must therefore be optimal from their point of view given the constraints faced, the characteristics of the CEO, and the extant patterns of external and internal governance.

An optimal contract between the CEO and the board maximizes profits subject to individual rationality and incentive compatibility constraints. Formally, we describe the contracting problem in the following program:

$$\max_{w,a\in\{L,H\}} (1-p_a)(y - d_a y - w) + p_a (y - d_a y - \tilde{w}) = y - w - (1-p_a) d_a y, \tag{1}$$

subject to: (i) the individual rationality constraint, which requires that the contract compensates the CEO for his power V,

$$p_a \frac{(w - \eta d_a y)^{1-\gamma}}{1-\gamma} + (1-p_a) \frac{(w + d_a y)^{1-\gamma}}{1-\gamma} - g(a) \geq V; \tag{2}$$

(ii) the incentive compatibility constraint, which requires that the CEO has no incentive to deviate from the prescribed choice of governance (or effort level),

$$a \in \arg \max_{e\in\{L,H\}} p_e \frac{(w - \eta d_e y)^{1-\gamma}}{1-\gamma} + (1-p_e) \frac{(w + d_e y)^{1-\gamma}}{1-\gamma} - g(e); \tag{3}$$

and (*iii*) that diversion d_a is optimal given the wage w and the action a,

$$d_a \in \arg\max_d p_a \frac{(w - \eta dy)^{1-\gamma}}{1-\gamma} + (1 - p_a) \frac{(w + dy)^{1-\gamma}}{1-\gamma}. \tag{4}$$

2.2 Discussion of assumptions

Nonverifiability of effort. We interpret the probability of successful monitoring as the *effectiveness* of the firm's internal governance. Engaging in effort to change this probability is thus equivalent to spending effort changing governance. For example, effort could be spent by the CEO in developing creative accounting in an attempt to fool auditors or, as could be inferred from Gillette et al. (2003), in filling the executive suite with inside board members.

Strictly speaking governance and governance changes are observable. However, our interpretation of the nonverifiability of effort is an assumption on the nonverifiability of the *effectiveness* of governance. We argue that this assumption is quite plausible, because in practice many governance rules are not unequivocally bad to shareholders, but CEOs can make them so. Therefore, below we use the terms 'monitoring probability' or 'governance' interchangeably.

To illustrate consider the following examples. Anti-takeover measures such as poison pills can be good to shareholders by blocking unsolicited tender offers. They can also harm shareholders depending on how the CEO and the board respond to a less threatening market for corporate control (see Brickley et al. (1994) on how the market reacts to the adoption of anti-takeover measures as a function of board independence). Another example is the willingness of CEOs to sell bonds offering a 'change-of-control' clause to bondholders. This clause protects bondholders from leveraged buyouts that decrease the rating of the firm by forcing the firm to buy back the debt. Hence, they can be justified to shareholders with the low cost of borrowing they offer. However, they also entrench management by making takeovers more costly. Interestingly, poison pills have fallen out of favor due to strong criticism by activist investors, while it has become quite popular to sell bonds with change-of-control covenants. Our assumption of the nonverifiability of the effectiveness of governance is based on the notion that a reasonable case can be made that poison pills and change-of-control covenants are beneficial to shareholders.

There are a variety of other rules, also not unambiguously bad (see Bebchuk et al. (2004) and Gompers et al. (2004)), whose adoption and impact on governance effectiveness depend

on CEO effort: rules allowing special meetings of shareholders to be called only by the board and the chairman, rules eliminating the right of shareholders to act by written consent, rules restricting the removal of directors and filling of vacancies, or the stipulation of supermajority provisions requiring two-thirds or more of shareholder votes to change such rules. While these rules can limit monitoring or its effectiveness by giving CEOs more leeway in the choice of firm policies and a greater opportunity for board capture, they are often justified by CEOs by the need to focus on long term company objectives. Indeed, Burkart et al. (1997) show that they can be optimal for shareholders as they lead to more CEO initiative.

The wage contract. As pointed out earlier, we may interpret CEO pay w as the fixed wage paid before monitoring takes place. We believe this is a realistic interpretation and offer the following justification. First, most employment contracts have intra-annual installments, though only annual reports are audited by outside firms (when reports are filed to the SEC within one month of the end of the year, all wages, though not bonuses, have already been paid).[8] Second, the recent accounting scandals of WorldCom, Enron, ABB, and others are testimony to the fact that detecting wrongdoing and fraud is often random, relies on 'whistler blowers,' or is triggered by bankruptcy or regulatory probes, and generally occurs with a *lag* of 1 or more years after which even bonuses have been paid out. Finally, even in the cases where expropriation occurs via misallocation of company funds (e.g., overinvestment, transfer pricing and tunnelling that hurts minority shareholders), CEOs are able to maintain significant pay from their firms when they are fired for bad performance through the use of golden parachutes and stock grants vesting at exit. Obviously, if all compensation is in the form of deferred or restricted pay CEOs get nothing upon being fired with cause, but these cases appear to be rare. CEOs are generally not at will employees and dismissal with cause is "protective of the CEO by sharply circumscribing the conduct for which they can be terminated" (see Schwab and Thomas (2006), pp. 3-4).

Our other assumption restricting the contracts we consider is that when monitoring is successful CEOs become liable to shareholders for returning the money diverted, dy. While this offers little controversy,[9] it is strengthened by the fact that the Sarbanes-Oxley Act asks

[8] There has been a recent push for continuous auditing. Its implementation has forced external auditors to also review the quarterly reports, but they are not asked to conduct a comprehensive audit.

[9] A recent case is the court ruling requiring ex-HealthSouth CEO Richard Scrushy to return $48 million of

that bonuses and other incentive compensation be forfeited due to earnings re-statements, while CEOs retain the fixed portion of their compensation (the rule only applies if the re-statement occurs within 12 months of the original financial statement).

Other benefits of good firm governance. Several authors have analyzed the choice of firm-level governance in the context of a firm that needs equity financing to grow (e.g. Doidge et al. (2004, 2007)). Introducing a financing decision generally leads to a negative association between country-level investor protection and firm-level governance. Intuitively, better country-wide or firm-level governance allow the controlling shareholder to sell less shares of the firm each at a higher price and increase investment. If improving firm-level governance is costly from the insider's perspective while improving country-wide governance is not, then the controlling shareholder will avoid improving firm governance if country-wide laws improve. Doidge et al. (2007) show that this mechanism appears relevant for countries with low levels of financial development.

In our model, there is an asymmetry in the costs of setting-up firm governance. There are no costs in choosing the better governance, but there is an effort cost if the CEO chooses the weaker governance structure. This cost asymmetry implies that introducing equity financing into our setup would still yield the result in Durnev and Kim (2005) and Klapper and Love (2004).

2.3 First-best contract

Before we analyze the preceding model, we consider the first best contract. In the first best case, both effort and diversion are observable and verifiable. Thus, the incentive constraints (3) and (4) are absent. We write this problem when effort level a is implemented as follows:

$$\left(w^{FB}, d_a^{FB}\right) = \arg\max_{w, d_a} y - w - (1 - p_a)\, d_a y, \tag{5}$$

subject to

$$p_a u\left(w - \eta d_a y\right) + (1 - p_a)\, u\left(w + d_a y\right) - g\left(a\right) \geq V. \tag{6}$$

Simple algebra shows that $d_a^{FB} = 0$, and $w_a^{FB} = u^{-1}\left(V + g\left(a\right)\right)$. Thus, in the first best, there is no extraction of private benefits. Moreover, since $w_H^{FB} > w_L^{FB}$, implementing low

performance-based bonuses, whether or not he was aware of the accounting fraud that inflated company earnings.

effort is optimal to the shareholders in the first-best contract for any level of risk aversion and managerial power. Powerful CEOs, with high V, extract a high wage payment, but produce no adverse governance changes. In summary:

Lemma 1 *For any level of CEO power, the first-best contract supports low effort by the CEO and no diversion.*

The intuition for the inefficiency of private benefits is two-fold. First, diversion is inefficient even if the CEO is risk neutral: if the CEO is caught and private benefits are positive he pays deadweight fees of $\eta d_a y$. Second, diversion is inefficient even if fees are zero, i.e., $\eta = 0$: diversion income adds volatility to the consumption of the risk-averse CEO. If zero private benefits is optimal, then it is also optimal to not spend any effort changing governance.

3 Model Solution

To solve the optimal contracting problem (1) in the presence of moral hazard, we first derive the CEO's optimal diversion rate. We then derive the individually rational and incentive compatible contracts when low effort or high effort are implemented. We finally obtain the optimal contract by choosing the wage rate that implements the level of effort that maximizes shareholder value or expected profits.

3.1 Optimal diversion

We start by solving the optimal diversion rate as a solution to problem (4). The first-order condition for (4) is

$$y\left(1-p_a\right)\left(w+d_a y\right)^{-\gamma} = \eta y p_a \left(w-\eta d_a y\right)^{-\gamma}. \tag{7}$$

The left hand side is the marginal benefit of diversion and occurs only with probability $1-p_a$, if the CEO is not successfully monitored. The right hand side is the marginal cost. When monitoring is successful, which occurs with probability p_a, he receives wage $\tilde{w} = w - d_a y$ plus diversion $d_a y$ and pays a fee of $\eta d_a y$ that increases linearly in d_a. Solving out for d_a yields the following lemma. All proofs are contained in the appendix.

Lemma 2 ***(Optimal diversion)*** *Suppose $y > w$ and*

$$q_a \equiv \frac{(\eta p_a/(1-p_a))^{-1/\gamma} - 1}{1 + \eta\,(\eta p_a/(1-p_a))^{-1/\gamma}} \in (0,1)\,. \tag{8}$$

Then the CEO's optimal diversion rate is given by

$$d_a(w) = \frac{w}{y} q_a. \tag{9}$$

Moreover, $\partial d_a(w)/\partial \eta < 0$, $\partial d_a(w)/\partial p_a < 0$, and $\partial d_a(w)/\partial \gamma < 0$.

Equation (9) reveals that the diversion rate is increasing in wage w, ceteris paribus. This result holds true for general utility functions having the decreasing absolute risk aversion property and is critical in understanding the moral hazard problem studied here.[10] The intuition for this perverse effect of wages is that when the CEO receives higher wages his absolute risk aversion declines making him more willing to take a larger gamble in diverting output (i.e., d_a increases). In other words, there is a complementarity between diversion and wages, establishing a positive correlation between the two.[11] Evidence of this complementarity can be found in Johnson et al. (2009) where it is shown that managers at fraud firms earn significantly more total pay than executives at industry-size-matched control firms.

Equation (9) also reveals that, holding wages constant, diversion is decreasing in the quality of external governance η as well as in the quality of internal governance p_a. Further $\partial^2 d_a(w)/\partial p_a \partial \eta \geq 0$ for values of γ around 1.[12] For values of γ around 1 internal and external governance are substitutes in limiting diversion: the higher the monitoring intensity p_a,

[10] See Becker (2006) for evidence consistent with CEOs' preferences displaying decreasing absolute risk aversion.

[11] To see this complementarity explicitly, write expected utility (minus the effort cost) as a function of diversion and wages:

$$U(w, d_a) \equiv p_a \frac{(w - \eta d_a y)^{1-\gamma}}{1-\gamma} + (1-p_a)\frac{(w + d_a y)^{1-\gamma}}{1-\gamma}.$$

Straightforward differentiation yields (evaluated at the optimum d_a):

$$\frac{\partial^2 U(w, d_a)}{\partial w \partial d_a} = \gamma y p_a \eta\,(w - \eta d_a y)^{-\gamma-1}\left[1 - (\eta p_a/(1-p_a))^{1/\gamma}\right],$$

which is positive iff diversion is positive.

[12] The partial derivative $\partial d_a(w)/\partial p_a$ when $\gamma = 1$ equals

$$\frac{\partial d_a(w)}{\partial p_a} = -(p_a/(1-p_a))^{-2}\,\frac{\eta^{-1}+1}{\left(1 + (p_a/(1-p_a))^{-1}\right)^2},$$

which is increasing in η. By continuity we also have $\partial d_a(w)/\partial p_a \geq 0$ for values of γ around 1.

the lower the effectiveness of the outside deadweight fee in limiting diversion, i.e., $\partial d_a(w)/\partial\eta$ becomes less negative. Also, the optimal diversion rate is a decreasing function of the size y of the firm. This last result stands in sharp contrast with models that approach governance in a reduced form way and generate constant diversion rates (La Porta et al. (2002)). As Albuquerque and Wang (2008) show in the context of a general equilibrium model with a linear technology, a constant diversion rate generates overinvestment. This may no longer be the case if diversion is inversely proportional to firm size y.

In Lemma 2, the term q_a is the ratio of diversion income to wage pay. This ratio is linked to the risk-taking propensity of the CEO; it is decreasing in risk aversion as more risk-averse CEOs would rather have a greater portion of their total income come from formal pay as opposed to diversion benefits. This result derives from the fact that diversion generates suboptimal CEO-consumption volatility and will be helpful later on in understanding the different governance choices of CEOs with respect to different risk aversion.

A sufficient condition for (8) that guarantees an interior solution for diversion (given $y > w$) is

$$\frac{1-p_a}{p_a} > \eta > 1, \tag{10}$$

for all a. In fact, the first inequality in (10) is necessary and sufficient to ensure that diversion is positive for all a. The condition states that internal governance is sufficiently poor (i.e., p_a is low enough) relative to external governance η. Our results need only that optimal diversion be positive in the high-effort scenario (i.e., $(1-p_H)/p_H > \eta$), so that it pays to spend effort to change governance. If $\eta \geq (1-p_H)/p_H$, then we obtain the corner solution in which diversion is zero and the first best is achieved. Since our objective is to study the implications of imperfect governance, we do not consider this uninteresting case. The condition that $\eta > 1$ is sufficient, but not necessary, to ensure that the diversion rate is below 1 (given $y > w$). We assume (10) from now on and will make it explicit when we relax this assumption. Throughout, we also assume that expected output y is large enough so that profits are always positive.

Given the optimal diversion rate d_a, we can derive the CEO's utility

$$p_a \frac{(w-\eta d_a y)^{1-\gamma}}{1-\gamma} + (1-p_a)\frac{(w+d_a y)^{1-\gamma}}{1-\gamma} - g(a) = \frac{w^{1-\gamma}}{1-\gamma}A_a - g(a), \tag{11}$$

where the term A_a is defined as

$$A_a \equiv p_a \left(1+\eta\right)^{1-\gamma} \left[1+\eta\left(\frac{\eta p_a}{1-p_a}\right)^{-1/\gamma}\right]^{\gamma} > 0, \tag{12}$$

summarizes the net-benefits of diversion in utility terms or the certainty equivalent level of consumption. Under the maintained assumption (10), it is straightforward to show that:

Lemma 3 *We have* $(1-\gamma)\,\partial \log A_a/\partial p_a < 0$. *Thus,* $A_L < A_H$ *for* $\gamma < 1$, *and* $A_L > A_H$ *for* $\gamma > 1$.

It follows from this lemma and equation (11) that an increase in monitoring intensity p_a lowers CEO utility. This is intuitive since a higher probability p_a of being caught lowers the net benefits of diversion, ceteris paribus.[13]

3.2 Implementing low effort

In this subsection, we solve for the contract when low effort is implemented. By Lemma 2 and (11), we can rewrite the incentive constraint (3) and the individual rationality constraint (2) as

$$\frac{w^{1-\gamma}}{1-\gamma}A_L \geq V, \tag{13}$$

$$\frac{w^{1-\gamma}}{1-\gamma}A_L \geq -k + \frac{w^{1-\gamma}}{1-\gamma}A_H. \tag{14}$$

The contract wage w_L that implements low effort solves

$$\max_{w} y - w - \left(1-p_L\right) d_L\left(w\right) y, \tag{15}$$

subject to (13)-(14). Here $d_L\left(w\right)$ is given by (9) for $a = L$. Note that given an effort choice, the problem of choosing w to maximize profits is equivalent to the problem of minimizing w.

The following lemma presents the solution. To facilitate the exposition, we define a critical reservation value

$$V_1^* \equiv \frac{kA_L}{A_H - A_L}. \tag{16}$$

This value is such that both the individual rationality constraint (13) and the incentive compatibility constraint (14) are binding.

[13] Note that when $\gamma > 1$, a lower A (adjusted by $1-\gamma < 0$) means higher utility for constant wage.

Lemma 4 ***(Implementing low effort)*** *Suppose the low effort level is implemented.*

(i) Consider $\gamma < 1$. Then $V \leq V_1^*$ is necessary, the wage is

$$w_L = \left[\frac{(1-\gamma)\,V}{A_L}\right]^{\frac{1}{1-\gamma}}, \tag{17}$$

and the profit is

$$\pi_L(V) = y - [1 + (1-p_L)\,q_L]\left[\frac{(1-\gamma)\,V}{A_L}\right]^{\frac{1}{1-\gamma}}. \tag{18}$$

(ii) Consider $\gamma > 1$. If $V \geq V_1^*$, then the wage and the profit are given by (17) and (18), respectively. If $V < V_1^*$, then the wage is

$$w_L = \left[\frac{(1-\gamma)\,k}{A_H - A_L}\right]^{1/(1-\gamma)}, \tag{19}$$

and the profit is

$$\pi_L(V) = y - (1 + (1-p_L)\,q_L)\left[\frac{(1-\gamma)\,k}{A_H - A_L}\right]^{1/(1-\gamma)}. \tag{20}$$

The intuition for this lemma is the following. The choice of w trades off incentive provision (through the incentive constraint) and rent extraction (through the individually rationality constraint). By offering a lower wage the board extracts more rents from the CEO, which tightens the individual rationality constraint (13), but in so doing it may destroy the CEO's incentive to behave, violating incentive constraint (14).

An important result of Lemma 4 is that the wage contract depends critically on CEO risk aversion. To understand this result, re-write the incentive constraint (14) as

$$\frac{w^{1-\gamma}}{1-\gamma}(A_H - A_L) \leq k. \tag{21}$$

To implement low effort, the benefit from changing governance cannot exceed the associated cost. By Lemma 3, this benefit increases with wage when $\gamma < 1$ and decreases with wage when $\gamma > 1$. Intuitively, when CEO risk aversion is high enough, he has less incentive to change governance since he prefers to enjoy a higher wage rather than to take the risks associated with the extraction of private benefits. The opposite result holds true for a CEO with low risk aversion.

Given the preceding analysis, we can deduce that lowering formal pay to a CEO with $\gamma > 1$ tightens both the individual rationality constraint (13) and the incentive constraint (21). If

CEO power V exceeds the critical value V_1^* defined in (16), it will be optimal for the board to offer a wage such that it makes the CEO's individual rationality constraint (13) bind without destroying his incentive constraint. If $V < V_1^*$, it will be optimal for the board to offer a wage such that the incentive constraint constraint (21) binds. At this wage, the individual rationality constraint (13) is satisfied.

By contrast, lowering the wage to a CEO with $\gamma < 1$ tightens the individual rationality constraint (13), but relaxes the incentive constraint (21). Thus, the optimal wage that implements low effort must make the individual rationality constraint bind. Moreover, CEO power V cannot be too high such that $V > V_1^*$. Otherwise, CEO pay is so high that he has an incentive to change governance, violating the incentive constraint (21).

3.3 Implementing high effort

We now turn to implementing a high effort level. As in the previous subsection, we use Lemma 2 and (11) to rewrite the incentive constraint (3) and the individual rationality constraint (2):

$$-k + \frac{w^{1-\gamma}}{1-\gamma} A_H \geq V, \tag{22}$$

$$-k + \frac{w^{1-\gamma}}{1-\gamma} A_H \geq \frac{w^{1-\gamma}}{1-\gamma} A_L. \tag{23}$$

The contract wage w_H that implements high effort solves

$$\max_w y - w - (1 - p_H)\, d_H(w)\, y, \tag{24}$$

subject to (22)-(23). Here $d_H(w)$ is given by (9) for $a = H$. Again note that given an effort choice, the problem of choosing w to maximize profits is equivalent to the problem of minimizing w. The following lemma presents the solution.

Lemma 5 ***(Implementing high effort)*** *Suppose the high effort level is implemented.*

(i) Consider $\gamma < 1$. If $V \geq V_1^*$, then the wage is given by

$$w_H = \left[\frac{(1-\gamma)(V+k)}{A_H} \right]^{\frac{1}{1-\gamma}}, \tag{25}$$

and the profit is given by

$$\pi_H(V) = y - (1 + (1 - p_H) q_H) \left[\frac{(V+k)(1-\gamma)}{A_H} \right]^{\frac{1}{1-\gamma}}. \tag{26}$$

If $V < V_1^*$, then the wage is given by

$$w_H = \left[\frac{(1-\gamma)\,k}{A_H - A_L}\right]^{\frac{1}{1-\gamma}}, \tag{27}$$

and the profit is given by

$$\pi_H(V) = y - (1 + (1-p_H)\,q_H)\left[\frac{(1-\gamma)\,k}{A_H - A_L}\right]^{\frac{1}{1-\gamma}}. \tag{28}$$

(ii) Consider $\gamma > 1$. Then $V < V_1^*$ is necessary, and the wage and the profit are given by (25)-(26), respectively.

We note that V_1^* defined in (16) is such that both the individual rationality constraint (22) and the incentive constraint (23) are binding. In contrast to Lemma 4, when $\gamma < 1$, for any level of CEO power, lowering formal pay tightens both the constraints (22) and (23). To a less powerful CEO (with $V < V_1^*$) the board pays a fixed wage that is just incentive compatible and to a more powerful CEO (with $V \geq V_1^*$) the board has to pay a higher wage to meet his individual rationality constraint.

For CEOs with $\gamma > 1$, the board can only force the implementation of high effort to those that are less powerful (i.e., $V < V_1^*$). Powerful CEOs, with $V \geq V_1^*$, demand high wages and reject the consumption volatility that arises from private benefits. Because a high wage makes the CEO with high risk aversion less willing to change governance, the incentive constraint (23) would be violated.

3.4 The optimal contract

To solve for the optimal contract the board compares expected profits under high and low effort. It then chooses the wage rate that implements the effort level consistent with higher profits.

To facilitate exposition, we define the following critical value:

$$V_2^* \equiv \left(\frac{1 + (1-p_L)\,q_L}{1 + (1-p_H)\,q_H}\right)^{1-\gamma} \frac{kA_H}{A_H - A_L} - k. \tag{29}$$

At this value of CEO power the board is indifferent between changing governance and not changing governance for a CEO with high risk aversion ($\gamma > 1$). Lemma 6 in the appendix shows that $V_2^* < V_1^*$. Combining the results from the previous lemmas, we obtain the next proposition.

Proposition 1 ***(Optimal contract)*** *The shape of the contract depends on the CEO's risk aversion parameter as follows:*

(i) Consider $\gamma < 1$*. If* $V > V_1^*$*, then governance is changed, and the optimal wage and profit are given by (25)-(26), respectively. If* $V < V_1^*$*, then governance is not changed, and the optimal wage and profit are given by (17)-(18), respectively.*

(ii) Consider $\gamma > 1$*. If* $V > V_1^*$*, then governance is not changed, and the optimal wage and profit are given by (17)-(18), respectively. If* $V_2^* < V < V_1^*$*, then governance is not changed, and the optimal wage and profit are given by (19)-(20), respectively. If* $V < V_2^*$*, then governance is changed, and the optimal wage and profit are given by (25)-(26), respectively.*

Figure 2 plots the Pareto frontier between the CEO and the board (i.e., profit function) implied by Proposition 1. The horizontal axis represents CEO power V and the vertical axis represents shareholder value. Note that for $\gamma > 1$, in the left panel, V takes on negative values. In the region $V_2^* < V < V_1^*$, implementing low effort is optimal. In addition, since the incentive constraint binds, the optimal wage and shareholder value are flat by Lemma 4. For all other regions, the optimal wage is such that the individual rationality constraint binds. In addition, shareholder value is a locally concave function of V.[14]

[Figure 2 here.]

Proposition 1 implies that power is used by CEOs in two ways. First, CEOs with high risk aversion use their power to obtain high compensation and do not change governance or extract much private benefits. This accords with the story in Bebchuk et al. (2002). Second, CEOs with low risk aversion use their power to change governance and divert proportionately more output. This accords with the story in Hermalin and Weisbach (1998), Hellwig (2000) and others, who defend that management actively pursues (governance) changes in the way their compensation and incentives are granted.

To understand the intuition for the result in Proposition 1 note that an additional dollar of private benefits gives rise to a trade-off between increasing consumption as measured by

[14] Figure 2 shows that the Pareto frontier is not globally concave in CEO power V. This implies that randomizations over the contracts listed in Proposition 1 can improve shareholders' value. As is well known, random contracts are hard to interpret in practice. The details on such randomizations are available from the authors upon request.

$u'(c) = c^{-\gamma}$ and increasing consumption volatility as measured by the level of absolute risk aversion $-u''(c)/u'(c) = \gamma/c$. Consider the case of low risk aversion first $\gamma < 1$. In this case, the level of absolute risk aversion declines faster with increases in consumption than does the marginal utility of consumption. This means that a CEO with low power –and hence low consumption– has a greater concern for consumption volatility than for expected consumption relative to a CEO with high power –and hence high consumption– who cares more about increasing expected consumption even if at the cost of increased consumption volatility. That is why the later CEOs choose to change governance.[15]

Consider now the case of high risk aversion $\gamma > 1$. In this case, the relationships reverse and the marginal utility of consumption declines faster than the level of absolute risk aversion as consumption increases. This means that a CEO with low power –and hence low consumption– has less of a concern for consumption volatility than for increasing expected consumption relative to a CEO with high power –and hence high consumption– who cares a lot more about consumption volatility than about expected consumption. That is why the later never change governance whereas the low-consumption CEOs are willing to trade-off the higher concern for volatility for the much higher marginal utility of consumption and thus choose to change governance.

4 CEO power, CEO pay, and governance

In this section, we analyze the implications of the optimal contract derived in Proposition 1.

4.1 Good external governance breeds good internal governance

The most important result of our paper is the following:

Proposition 2 *For $\gamma < 1$, V_1^* increases with η. For $\gamma > 1$, V_2^* decreases with η if* [16]

$$\eta \geq \frac{1 - p_L}{p_L}. \tag{30}$$

Note that V_1^* and V_2^* are the cutoff values of CEO power such that shareholders are indifferent between changing and not changing governance. Propositions 1-2 then imply that

[15] Mathematically, when $\gamma < 1$ the two functions go to infinity at $c = 0$, but $u'(c) < \frac{-u''(c)}{u'(c)}$ for low c, and they both go to zero as $c \to \infty$, but $u'(c) > \frac{-u''(c)}{u'(c)}$ for high c. The inequalities flip sign when $\gamma > 1$.

[16] Note that we maintain the assumption $\eta < (1 - p_H)/p_H$ so that the first best solution cannot be obtained.

good external governance breeds good external governance because some CEOs who change governance will refrain from their misbehavior after an improvement in external governance.

This result is not obvious in our model since in the model external and internal governance can be substitutes in limiting diversion. Recall from our discussion in subsection 3.1 that for fixed wages, $\partial^2 d_a(w)/\partial\eta\partial p_a > 0$, for values of γ around 1, meaning that a higher monitoring intensity reduces the effectiveness of outside governance, i.e., $\partial d_a(w)/\partial\eta \leq 0$ increases. More of one should then reduce the need for the other.

The intuition for our result is that in the model better country-wide governance η increases the cost of diversion and makes it easier to incentivize the CEO. This mechanism depends on the level of risk aversion. Consider a CEO with low risk aversion $\gamma < 1$. An improvement in country-wide governance increases the cost of diversion. The firm can now pay a higher wage to the CEO without unduly giving him incentives to take risks associated with weakening governance. The agency problem is alleviated and more CEOs choose not to spend effort trying to influence the board. Formally, the result obtains because the critical value V_1^* increases with η and governance is not changed for CEOs with low power $V < V_1^*$ by Proposition 1.

Consider now a CEO with high risk aversion $\gamma > 1$ whose V is just below V_2^*. Recall that CEOs trade off the increase in expected consumption arising from an extra dollar of private benefits against the associated increase in consumption volatility. With $\gamma > 1$ and $V < V_2^*$, the CEO values the increase in expected consumption more than the increase in volatility of consumption. This is why he wishes to change governance (see Proposition 1). When external governance improves not only expected consumption decreases, but also consumption volatility increases, *ceteris paribus*. Therefore, the CEO with V just below V_2^* prefers not to change governance. Formally, when $\gamma > 1$, the result of a positive relationship between external and internal governance obtains because V_2^* decreases with η. Note that we derive this result under the condition (30). This condition violates the assumption in Lemma 2 and implies that CEOs will not divert output (i.e., $d_L = 0$ and $A_L = 1$) when governance is strong, thereby resulting in deterministic consumption. Without this condition, CEOs always divert output, and an improvement in external governance raises the volatility of consumption for both high and low effort, blurring our preceding intuition.[17]

[17] Although we are unable to derive Proposition 2 analytically without condition (30), we have verified it holds true numerically for a wide range of parameter values.

The positive association between external and internal governance implies that country-wide improvements in governance generate a "race to the top" in internal governance as well. In the introduction to this paper we point out that the wave of firms announcing that they would voluntarily start to expense CEO options following Sarbanes-Oxley is consistent with this prediction. It is also consistent with the changes in board composition and meeting practices reported in Linck et al. (2009).

Our result is also consistent with Durnev and Kim (2005) and Klapper and Love (2004) who use a new panel dataset from Credit Lyonnais Securities Asia (CLSA) on cross-country measurements of firm-level and country-wide governance. Regressing firm-level governance on country-wide legal rules they find a positive correlation after controlling for a range of firm and country effects. Their empirical finding is puzzling in light of the view that external governance acts as a substitute for internal governance. This view is influenced by the observation in La Porta et al. (1998) of a negative correlation of shareholder ownership and country-wide investor protection, as well as by the theories that argue that debt and the market for corporate control can act as a disciplining device in the absence of good firm governance (see Jensen (1986), Shleifer and Vishny (1997), and Hauswald and Marquez (2005)).

LLSV (1998) argue that the quality of internal governance is dictated by the quality of external governance because from a legal point of view opting out of the legal standard is costly due to poor enforcement of non-standard contracts. In contrast, Easterbrook and Fischel (1996) argue that legal rules are not binding in most instances and often firms opt out of these rules in their corporate charters. Evidence in favor of the opting-out hypothesis is given in Klapper and Love (2004) and Durnev and Kim (2005) for various countries, and Gompers et al. (2004) across US firms. These papers show that (i) there is considerable variation in firm-governance indicators within countries and (ii) firm value is significantly affected by the level of internal governance after controlling for country-wide governance. By contrast, our model provides an intuitive economic explanation based on a simple contracting model.

Durnev and Kim (2005) predict a negative relationship between external governance and the dollar value of diversion, which they interpret as inducing a positive association between the quality of external and internal governance. However, changing the dollar value of diversion does not necessarily guarantee that internal governance laws are changed as can be seen in

Proposition 1. Moreover, the findings in Atanassov and Kim (2009) suggest that in countries with weak governance and strong labor unions, collusion between management and labor might stall any internal reform in the face of external changes (see also Pagano and Volpin (2005)).

4.2 External governance reform and CEO pay

Improvements in external governance need not lead to lower wages. Indeed, CEOs may demand higher wages to be willing to give up their diversion income. We have the next result:

Proposition 3 *An improvement in external governance η leads to an increase in wage if $\gamma < 1$, or if $\gamma > 1$ with either $V > V_1^*$ or $V < V_2^*$. Under condition (30), the wage rate decreases after improvements in external governance η if $\gamma > 1$ and $V_2^* < V < V_1^*$.*

The intuition for this result is the following. Except for $\gamma > 1$ and $V_2^* < V < V_1^*$, the optimal wage is such that the individual rationality constraint binds. Since diversion decreases with η by Lemma 2, wages must increase with η to guarantee that the CEO receives the reservation utility V. In other words, the CEO has a strong appetite for private benefits and must be compensated in other ways if the cost of extracting private benefits increases.

When $\gamma > 1$ and $V_2^* < V < V_1^*$, the firm pays an incentive-compatible wage to the CEO. Because the benefits of diversion are lower with improvements in external governance, the firm can decrease CEO pay and yet maintain the incentives to not weaken governance.

Proposition 3 implies that changes in external governance may be accompanied by increases in CEO pay as they substitute away from private benefits, which is consistent with the touted increase in CEO pay after SOX.[18] It is an interesting empirical question to separate this pay increase between what is justified by the added certification requirements on CEOs and what is needed to compensate for the lower extraction of private benefits.

4.3 The association between internal governance and CEO pay

Core et al. (1999) find empirical evidence that firms with weaker governance pay more to their CEOs (see Bebchuk and Fried (2005) and Thomas (2004) for surveys). In our model this is true for firms with CEOs with low risk aversion ($\gamma < 1$). To see this note from Proposition 1 that CEO pay w is an increasing function of CEO power, ceteris paribus, whereas for $\gamma < 1$

[18] For example, "Special Report: CEO pay 'business as usual'," in USA Today, March 2005.

the monitoring intensity p_a is a weakly increasing function of CEO power. As shown on the right panel of Figure 2, when CEO power V is increased from a value less than V_1^* to a value higher than V_1^*, internal governance is worsened. This proves that:

Proposition 4 *When $\gamma < 1$, cross-sectional variation in CEO power induces a negative association between the quality of internal governance and CEO pay.*

Our explanation of Core et al. (1999) is related to the argument in Bebchuk et al. (2002). Bebchuk et al. (2002) argue that in firms with poorer governance, CEOs can more easily exert their influence over the board of directors and demand higher pay. Hence, according to Bebchuk et al. (2002) there is a direct causal link between firm governance and CEO pay. While our explanation also relies on CEOs exerting their power over the board, in our model the established correlation arises due to the endogeneity of firm governance and cross-sectional variation in CEO power: the association between weaker governance and higher wages is brought about by variation in CEO power. Hermalin (2005), and his discussion of Hermalin and Weisbach (1998), predicts that less board diligence, interpreted as weaker internal governance, is associated with higher wages. However, in his setup, but not in Hermalin and Weisbach (1998), this association is driven by CEO ability and not CEO power.

Direct evidence in favor of a correlation that is driven by CEO power (as in Proposition 4 above) is given in Malmendier and Tate (2009). These authors find that CEOs that receive prestigious awards by the business press, which we interpret as increasing their power, have their compensation increase at the same time that the incidence of earnings management increases.

Proposition 4 predicts that the ratcheting effect in wages detected by Bizjak et al. (2008) leads to a worsening of governance practices if CEOs have low risk aversion. According to Bizjak et al., compensation committees try to keep CEO pay at or above the median level of the peer group. If pay increases due to exogenous reasons, CEOs may feel less risk averse as their compensation increases and become more willing to change governance.

For CEOs with high risk aversion the relationship is reversed, because when $\gamma > 1$ high powered CEOs prefer high formal pay to diversion income. The added volatility associated with diversion income is too costly for these CEOs and they are not willing to pay the effort cost to change governance.

4.4 International pay gap

There is considerable evidence that CEOs in the United States receive higher average pay than CEOs outside of the United States, namely in Japan (e.g. Kaplan (1994)). Our model explains this discrepancy if the United States and other countries have different distributions of CEO power. In particular, suppose that there are relatively more high powered CEOs in the United States than in Japan. Formally, the distribution of CEO power in the United States first order stochastically dominates that in Japan: for every possible level of CEO power V, the measure of CEOs with power equal to, or lower than V is higher in the United States than in Japan. Because Proposition 1 shows that the optimal wage schedule is increasing in CEO power, the average CEO wage in the United States is therefore higher. Formally,

Proposition 5 *If the distribution of CEO power in the United States first order stochastically dominates that in Japan, the average wage in the United States is higher.*

The assumption we make that there are relatively more high powered CEOs in the United States than in Japan is in accordance with Bebchuk et al. (2002) who argue that the greater dispersion of outside shareholders in the United States leads to more managerial power in the United States with subsequent increased ability to extract higher wages.

5 Conclusion

We have developed a model built on the premise that CEOs are the main promoters of governance change within a corporation in the line of Hermalin and Weisbach (1998) and Hellwig (2000). The model assumes that changes in governance effectiveness promoted by the CEO are nonverifiable leading to a moral hazard problem. The model highlights the role of CEO power and managerial risk aversion in the pursuit of private benefits versus formal pay and governance changes. The model has predictions for how internal governance is affected by CEO power, country-wide governance and exogenous changes in CEO pay.

In our analysis we have treated CEO power as exogenous. This allows us to study how changes in the external environment, like the Sarbanes-Oxley Act, affect incentives in exercising CEO power, but does not allow us to comment on how CEO power itself is affected by Sarbanes-Oxley. To do that we need an explicit model of how CEO power is determined, which requires,

among other things, setting up a market for CEOs and a framework to value the various attributes of CEOs. We view the current paper as a building block toward this more general setup.

Appendices

A Proofs

Proof of Lemma 1: It follows from the first-order condition and simple algebra. ■

Proof of Lemma 2: Using the first-order condition (7), we can solve for the diversion rate given in (9). This solution is indeed optimal since the objective function in (4) is concave in d_a. Assumption 10 ensures that $d_a(w) \in (0,1)$. To show $\partial d_a(w)/\partial \eta < 0$ and $\partial d_a(w)/\partial p_a < 0$, we use (7). An increase in η raises the marginal cost of diversion, which is represented by the expression on the left side of (7). But it does not change the marginal benefit from diversion, which is represented by the expression on the right side of (7). Thus, it lowers $d_a(w)$. By a similar reasoning, an increase in p_a lowers the marginal benefit from diversion and raises the marginal cost of diversion. Thus, it lowers $d_a(w)$. ■

Proof of Lemma 3: Given (12), we derive

$$\frac{\partial \log A_a}{\partial p_a} = \frac{1}{p_a} \frac{1 - \left(\frac{\eta p_a}{1-p_a}\right)^{-(1-\gamma)/\gamma}}{1 + \eta \left(\frac{\eta p_a}{1-p_a}\right)^{-1/\gamma}},$$

which is negative if and only if $\left(\frac{1-p_a}{p_a \eta}\right)^{-(1-\gamma)/\gamma} < 1$. Given the assumption (10), we have $\frac{1-p_a}{p_a} > \eta$, and deduce

$$\frac{\partial \log A_a}{\partial p_a} < (>) 0 \text{ if } \gamma < (>) 1. \tag{A.1}$$

Finally, since $p_L > p_H$, we obtain the desired result. ■

Proof of Lemma 4: We form the Lagrangian:

$$\begin{aligned} L &= y - w - (1 - p_L) w q_L + \lambda \left[\frac{w^{1-\gamma}}{1-\gamma} A_L - V \right] \\ &\quad + \mu \left[\frac{w^{1-\gamma}}{1-\gamma} A_L + k - \frac{w^{1-\gamma}}{1-\gamma} A_H \right], \end{aligned} \tag{A.2}$$

where $\lambda, \mu \geq 0$ are the Lagrange multipliers and satisfy the usual complementarity slackness conditions. The first-order condition is given by

$$1 + (1 - p_L) q_L = \lambda w^{-\gamma} A_L + \mu w^{-\gamma} [A_L - A_H]. \tag{A.3}$$

Thus, it is impossible for $\lambda = \mu = 0$. That is, one of the constraints (13) and (14) must bind.

(i) Consider $\gamma < 1$. If $V < V_1^*$, then (13) binds, and thus we can derive the wage w_L given in (17). This wage is such that (14) holds true. It follows that the profit is given by

$$y - w_L - (1 - p_L)\, d_L\,(w_L)\, y. \tag{A.4}$$

Using Lemma 2 and simplifying yields (18).

If $V > V_1^*$, then the individual rationality constraint (13) cannot bind. Thus, $\lambda = 0$. In order to satisfy (A.3), we must have $\mu > 0$ and $A_L > A_H$. But this contradicts Lemma 3.

(ii) Consider $\gamma > 1$. If $V \geq V_1^*$, then one can check that (13) binds and (14) does not bind. Thus, the wage and profit are given by (17)-(18) respectively. If $V < V_1^*$, then (14) binds and (13) does not bind. Thus, we can derive the wage w_L given in (19). Substituting this expression into (A.4) and using Lemma 2, we can derive (20). ■

Proof of Lemma 5: We form the Lagrangian:

$$\begin{aligned} L &= y - w - (1 - p_H)\, w q_H + \lambda \left[-k + \frac{w^{1-\gamma}}{1-\gamma} A_H - V \right] \\ &\quad + \mu \left[-k + \frac{w^{1-\gamma}}{1-\gamma} A_H - \frac{w^{1-\gamma}}{1-\gamma} A_L \right], \end{aligned} \tag{A.5}$$

where $\lambda, \mu \geq 0$ are the Lagrange multipliers and satisfy the usual complementarity slackness conditions. The first-order condition is given by

$$1 + (1 - p_H)\, q_H = \lambda w_H^{-\gamma} A_H + \mu w_H^{-\gamma} \left[A_H - A_L \right]. \tag{A.6}$$

Thus, it is impossible for $\lambda = \mu = 0$. That is, one of the constraints (22) and (23) must bind.

(i) Consider $\gamma < 1$. If $V > V_1^*$, then (22) binds and (23) does not bind. Thus, we can derive the wage w_H given in (25). It follows that the profit is given by

$$y - w_H - (1 - p_H)\, d_H\,(w_H)\, y. \tag{A.7}$$

Using Lemma 2 and simplifying yield (26).

If $V < V_1^*$, then the individual rationality constraint (22) cannot bind. Thus, $\lambda = 0$. In order to satisfy (A.6), we must have $\mu > 0$ and $A_H > A_L$. By Lemma 3, the latter can be true only if $\gamma < 1$. Since (23) binds, we can derive the wage w_H given in (27). Substituting this expression into (A.7) and using Lemma 2, we can derive (28).

(ii) Consider $\gamma > 1$. If $V < V_1^*$, then (22) bind and (23) does not bind. The wage and profit are given by (25)-(26). If $V > V_1^*$, then (23) binds and (22) does not bind. As argued earlier, $\gamma < 1$ is necessary. Thus, $V > V_1^*$ is impossible.

Finally, If $V = V_1^*$, both constraints (22) and (23) bind. Thus, we can derive the desired result. ■

Proof of Proposition 1: (i) Consider first $\gamma < 1$.

If $V > V_1^*$, then it follows from Lemma 4 that low effort cannot be implemented. By Lemma 5, high effort is implemented and the wage and profit are given by (25)-(26). If $V < V_1^*$, we compare profit in (18) and profit in (28) to determine which effort level is optimal to the shareholders. Since

$$\begin{aligned} & y - [1 + (1 - p_L) q_L] \left[\frac{(1-\gamma) V}{A_L} \right]^{\frac{1}{1-\gamma}} \\ > \quad & y - (1 + (1 - p_H) q_H) \left[\frac{(1-\gamma) k}{A_H - A_L} \right]^{\frac{1}{1-\gamma}}. \end{aligned} \tag{A.8}$$

iff

$$V < \frac{k A_L}{A_H - A_L} \left(\frac{1 + (1 - p_H) q_H}{1 + (1 - p_L) q_L} \right)^{1-\gamma} = V_1^* \left(\frac{1 + (1 - p_H) q_H}{1 + (1 - p_L) q_L} \right)^{1-\gamma} \tag{A.9}$$

Since by assumption $V < V_1^*$, to prove the preceding is true, we need the following lemma:

Lemma 6 *Let assumption (8) hold. Then*

$$(1 - p_H) q_H > (1 - p_L) q_L.$$

Proof. Use (8),

$$\begin{aligned} \frac{\partial \ln [(1 - p_a) q_a]}{\partial p_a} &= -\frac{1}{1 - p_a} - \frac{1}{\gamma p_a (1 - p_a)} \left(\frac{\eta p_a}{1 - p_a} \right)^{-1/\gamma} \\ &\quad \times \frac{1 + \eta}{\left[\left(\frac{\eta p_a}{1 - p_a} \right)^{-1/\gamma} - 1 \right] \left[1 + \eta \left(\frac{\eta p_a}{1 - p_a} \right)^{-1/\gamma} \right]} \end{aligned}$$

This expression is negative since $\eta p_a < 1 - p_a$ by assumption (8) or (10). Thus, the desired result follows from $p_H < p_L$. ■

(ii) Consider $\gamma > 1$.

Suppose $V > V_1^*$. Then by Lemma 5 high effort cannot be implemented. By Lemma 4, low effort is implemented and the wage and profit are given by (17)-(18).

Suppose $V_2^* < V < V_1^*$. We compare profit from implementing low effort given in (20) with profit from implementing high effort given in (26). Note that V_2^* is the value of V such that the two profit levels are equal. When $V_2^* < V < V_1^*$, we can check that we have

$$\begin{aligned} & \left(1+\left(1-p_H\right)q_H\right)\left[\frac{\left(V+k\right)\left(1-\gamma\right)}{A_H}\right]^{\frac{1}{1-\gamma}} \\ > \quad & \left(1+\left(1-p_L\right)q_L\right)\left[\frac{\left(1-\gamma\right)k}{A_H-A_L}\right]^{\frac{1}{1-\gamma}}. \end{aligned} \tag{A.10}$$

Thus, $\pi_L\left(V\right) > \pi_H\left(V\right)$ and low effort is optimal.

Finally, suppose $V < V_2^*$. We can check the opposite inequality holds in (A.10). Thus, $\pi_L\left(V\right) < \pi_H\left(V\right)$ and high effort is optimal. ■

Proof of Proposition 2: Differentiation gives

$$\frac{\partial \ln\left(A_H/A_L\right)}{\partial \eta} = \left(\gamma-1\right)\frac{\left(\frac{\eta p_H}{1-p_H}\right)^{-1/\gamma} - \left(\frac{\eta p_L}{1-p_L}\right)^{-1/\gamma}}{\left[1+\eta\left(\frac{\eta p_H}{1-p_H}\right)^{-1/\gamma}\right]\left[1+\eta\left(\frac{\eta p_L}{1-p_L}\right)^{-1/\gamma}\right]},$$

which is negative iff $\gamma < 1$. Since $\frac{\partial V_1^*}{\partial \eta}$ varies inversely with $\frac{\partial\left(A_H/A_L\right)}{\partial \eta}$ we get the desired result that V_1^* is increasing in η with low risk aversion, $\gamma < 1$. With a higher V_1^*, high-powered CEOs that otherwise would change governance are now restricted in what they can do.

For $\gamma > 1$, note that $A_L = 1$ under condition (30). In addition, q_H is decreasing in η as shown in Lemma 2. Differentiation yields

$$\frac{\partial}{\partial \eta}\left(\frac{A_H}{A_H-1}\right) = -\left(\gamma-1\right)\frac{A_H}{\left(A_H-1\right)^2}\frac{\left(\frac{\eta p_H}{1-p_H}\right)^{-1/\gamma} - 1}{\left[1+\eta\left(\frac{\eta p_H}{1-p_H}\right)^{-1/\gamma}\right]\left(1+\eta\right)},$$

which is negative iff $\gamma > 1$. Therefore, V_2^* decreases with η. ■

Proof of Proposition 3: Recall that the term A_a measures the net benefits of diversion. Differentiation yields

$$\frac{d \ln A_a}{d\eta} = -\left(1-\gamma\right)\frac{q_a}{1+\eta} \lesseqgtr 0 \text{ iff } \gamma \lesseqgtr 1. \tag{A.11}$$

Consider first the case of $\gamma < 1$. By Proposition 1, the optimal wage is given by (25) or (17). Since (A.11) implies that A_a decreases with η for $\gamma < 1$, the result follows.

Consider next the case where $\gamma > 1$, but $V > V_1^*$ or $V < V_2^*$. The optimal wage is given by (17) for $V > V_1^*$, and is given by (25) for $V < V_2^*$. Since (A.11) implies that A_a decreases with η for $\gamma > 1$, the result follows.

Finally, consider the case where $\gamma > 1$ and $V_2^* < V < V_1^*$. The optimal wage is given by (19). Given assumption (30), $A_L = 1$. We thus have

$$w_L = \left[\frac{(\gamma - 1)\, k}{1 - A_H}\right]^{1/(1-\gamma)},$$

which is rearranged to reflect the fact that when $\gamma > 1$, $A_H < 1$ (see Lemma 3). It follows that the wage rate decreases with η in this range of CEO power. ■

Proof of Proposition 4: See the main text. ■

Proof of Proposition 5: Proposition 1 implies that optimal wage is an increasing function of V. The result then follows from the definition of first-order stochastic dominance. ■

B The log-utility case ($\gamma = 1$)

Here, we treat the log-utility case, $u(c, a) = \log(c) - g(a)$. Lemma 2 applies when $\gamma = 1$ as well, yielding a value for d_a. We then write expected utility as

$$p_a u(w - \eta d_a y) + (1 - p_a)\, u(w + d_a y) = \log[w] + \log[A_a] - g(a),$$

where diversion benefits are summarized by the term

$$A_a = \frac{1 + \eta}{\left(\frac{\eta p_a}{1-p_a}\right)^{1-p_a} + \eta \left(\frac{\eta p_a}{1-p_a}\right)^{-p_a}}.$$

A_a has the property that $\frac{d \log(A_{p_a})}{dp_a} = \log\left(\frac{\eta p_a}{1-p_a}\right) < 0$. Using these results, the constraints needed to implement the low effort choice are

$$\begin{aligned} \log w + \log A_L &\geq V \\ \log w + \log A_L &\geq -k + \log w + \log A_H. \end{aligned} \tag{B.1}$$

The board's optimization problem can be solved to yield:

$$\begin{aligned} \lambda &= w\left(1+\left(1-p_L\right)q_L\right), \\ w &= A_L^{-1}\exp\left(V\right), \end{aligned}$$

where λ is the Lagrange multiplier associated with the individual rationality constraint. This solution is optimal iff $\log A_L \geq -k + \log A_H$ otherwise, high effort is optimal. In the log-utility case, CEO power does not affect incentives because there is a separability between wages and benefits of diversion and wages drop from the incentive constraint (B.1).

Similarly, the constraints needed to implement the high effort choice are

$$\begin{aligned} -k + \log w + \log A_H &\geq V \\ -k + \log w + \log A_H &\geq \log w + \log A_L, \end{aligned}$$

and the board's optimization problem yields:

$$\begin{aligned} \lambda &= w\left(1+\left(1-p_H\right)q_H\right) \\ w &= A_H^{-1}\exp\left(V+k\right), \end{aligned}$$

where λ is the Lagrange multiplier associated with the individual rationality constraint. As before, since wages do not affect incentives, lower rent extraction dictates that the individual rationality constraint always binds. This solution is optimal iff $\log A_L \leq -k + \log A_H$, otherwise low effort is optimal.

With log-utility either all CEOs choose $a = H$ or they all choose $a = L$ independent of managerial power and there is no role for randomizations.

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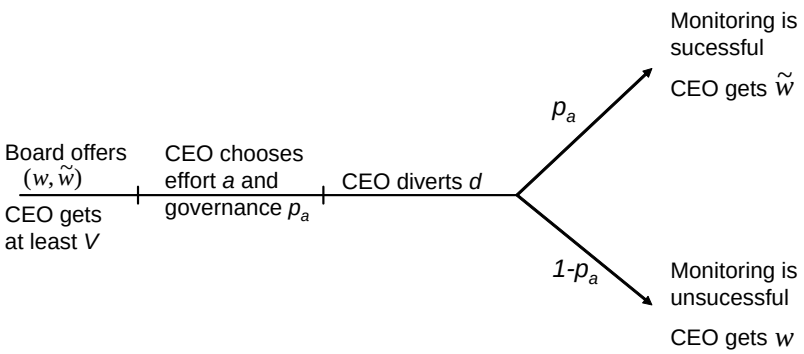

Figure 1: Timeline of Events.

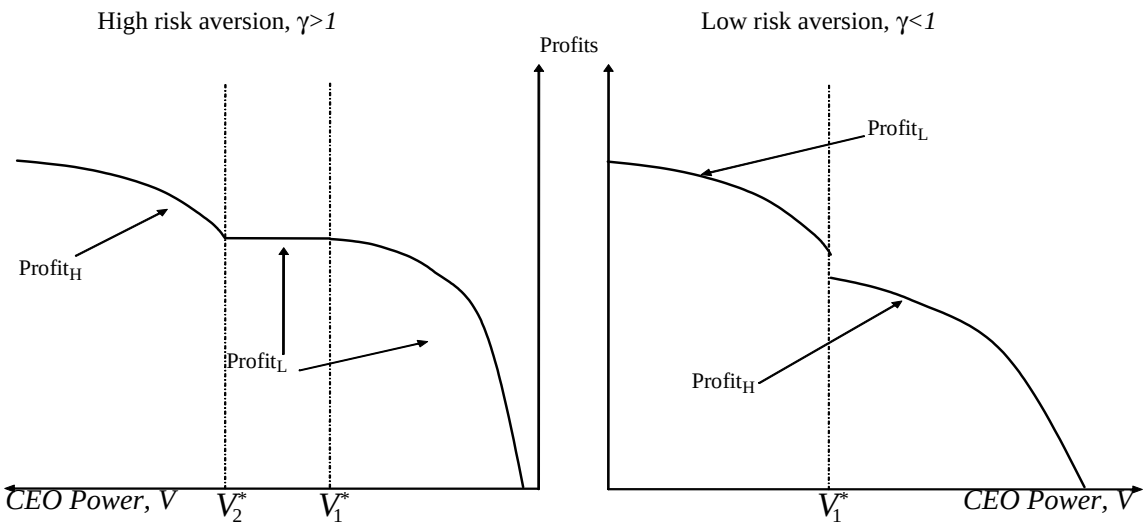

Figure 2: The figure plots the profit function. The left panel presents the case of high risk aversion, $\gamma > 1$, whereas the right panel presents the case of low risk aversion, $\gamma < 1$.