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ABSTRACT

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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 favour one or the other type of compensation. The model explains why good countrywide 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 based on CEO power. Finally, we discuss the optimality of introducing randomness in CEO hiring, for example, by evaluating CEOs based on qualitative characteristics, or soft skills, that are prone to diverse judgements.

JEL Classification: G34, J33 and K00
Keywords: CEO compensation, CEO power, investor protection and moral hazard

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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 (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, affect incentives in exercising CEO power.

We start by recognizing the role of the CEO in promoting governance changes and thus emphasizing the study of the agency conflict between shareholders and the CEO in the choice of governance. As we explain below, this agency conflict arises due to (i) the nonverifiability of changes in the effectiveness of governance practices, and (ii) imperfect, country-wide investor protection. In doing so, we distinguish ourselves from most of the endogenous governance literature that focuses either on the conflicts of interest between the board of directors and shareholders (e.g. Hermalin and Weisbach (1998) or Adams and Ferreira (2005)) or between the controlling shareholder and minority shareholders (e.g. Doidge, Karolyi, and Stulz (2004) and Doidge et. al (2005) in the context of equity financing). Our motivation is three-fold. First, our approach provides a model to study the implications of Hellwig's conjecture. Second, the evidence on board composition and firm performance is inconclusive (see Hermalin and Weisbach (2003) for a survey). Finally, we discuss below the potential for our approach to explain the empirical finding that poor, country-wide governance is associated with poor, firm-level governance.

We present a simple contracting model where 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 she 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 total income, which is costly for a CEO with risk aversion. In spite of these costs, positive private benefits occur because they are nonverifiable by the firm's shareholders,

if the CEO is not monitored. Moreover, to make it easier to extract private benefits, CEOs can spend effort to change 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 lower wage.

The first main result of the model is that whether or not CEOs pursue governance changes is determined by the interaction between CEO power and CEO risk aversion. In the model, a positive correlation between CEO pay and private benefits arises because higher pay makes the CEO more willing to take a larger gamble in diverting output. Hence, more powerful CEOs, who receive greater wages, extract more private benefits. It would then seem natural to conclude that if CEOs want to extract more private benefits they should engage in changing governance to facilitate it. However, the share of private benefits to formal pay is decreasing in risk aversion; CEOs with higher risk aversion prefer to exert their power by asking for relatively more formal pay. Consequently, powerful CEOs with high risk aversion never choose to spend effort to change governance, whereas powerful CEOs with low risk aversion have such appetite for private benefits that cannot be prevented from engaging in effort to change governance.

Our model thus implies that there is a negative relationship between governance and CEO pay for CEOs with low risk aversion. This negative relationship is consistent with the empirical finding in Core et al. (1999). The novelty of our paper is that this association is driven by cross-sectional variation in CEO power and dependent on risk aversion. Direct evidence in favor of our mechanism is given in Malmendier and Tate (2005). 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.

The second main result of the model is that good external governance breeds good internal governance. This result is surprising in our model, since we assume that external and internal governance are substitutes in limiting diversion. More of one should then reduce the need for the other. The particular mechanism driving this result depends on the level of risk aversion. With low risk aversion, CEOs that get paid more take greater gambles in diverting output and have greater incentives to worsen internal governance. When external governance improves,

this perverse incentive effect is weakened. It is then possible to give more formal pay to a CEO without unduly generating incentives to change governance, resulting in better overall firm-level governance. By contrast, with high risk aversion, it is the low-powered CEOs that receive too little formal pay to change governance. While we are unable to derive an analytical result for this case, numerical results suggest that when external governance improves, incentives can be granted more efficiently through formal pay and internal governance also improves.

The preceding result leads to the prediction that the Sarbanes-Oxley Act of 2002 should produce a general movement towards better firm-level governance. Arguably, anecdotal evidence suggests that indeed a "race to the top" was initiated at the time of the enactment of the Act with Coca-Cola in one day and the Washington Post Co. and Bank One in the next announcing that they would voluntarily start expensing executive stock options (long before FAS 123(R) requiring options' expensing was put in place). But better governance does not imply lower CEO pay. Indeed, the model predicts that CEO pay may increase as a result of Sarbanes-Oxley: CEOs substitute away from costlier private benefits and into formal pay. This increase in CEO pay is independent of any pay increase that might be justified by the higher certification costs implied by the Sarbanes-Oxley Act.

The result that good external governance breeds good internal governance provides an explanation for the recent puzzling empirical finding uncovered in Durnev and Kim (2005) and Klapper and Love (2004) 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 finding 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) and Shleifer and Vishny (1997)).

The final result of the paper is the optimality of randomness in the CEO recruiting process. We call this randomness a CEO-power lottery. The odds in this lottery are determined endogenously via the CEO's extant power, with CEOs coming to the negotiating table with more

power having better odds of increasing their power. This lottery is beneficial for shareholders as it creates a disciplining device for certain CEOs. The cost is that CEOs that otherwise would not change governance, absent the lottery, may end up spending the effort to do so as their power changes. We view the implementation of this power lottery as the process through which preferences are aggregated and consensus is built among the board of directors over a multitude of CEO characteristics. In this context, CEOs with greater extant power can more easily steer the board into putting greater weight on her preferred subset of characteristics. Power lotteries can explain the widespread use by CEO-search committees of CEO characteristics that are more qualitative, based on soft skills, that are prone to diverse judgements (e.g. Atkins (2004) and Charan (2000)).

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. However, as Easterbrook and Fischel (1991) claim, and LLSV admit, often legal rules are not binding and firms do opt out of them in their corporate charters. Moreover, there is considerable evidence in favor of the opting-out hypothesis in Klapper and Love (2004) and Durnev and Kim (2005) for a cross-section of countries, and Gompers et al. (2004) across US firms as these papers show that firm value is significantly affected by the level of internal governance after controlling for country-wide governance.

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, they extend Hermalin and Weisbach (1998) and Hermalin's (2005) adaptation of Holmstrom's (1999) career concern model.

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 considers an extension of the model that allows for randomness in the hiring process and Section 6 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 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. We assume that diversion is observable though non-verifiable unless monitoring takes place (Shleifer and Wolfenzon (2002)). If monitored, the CEO has to return the diverted output dy. We also assume that the CEO faces a punishment for diverting output. 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.

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 promoted by the CEO depends on her 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. With low effort, the probability of being monitored is p_L. Incurring high effort entails an effort cost of k, but allows the CEO to face a lower probability of being monitored $p_H < p_L$. 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.[1] 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 of monitoring p_a $(a = H, L)$ 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.

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 do not attach either interpretation to the effort cost k, because the effort cost does not directly impact diversion rates (see below). Instead, 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.[2]

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 no monitoring takes place and the wage $\tilde{w}$ is paid if the CEO is monitored. Alternatively, we may interpret the wage w as the fixed wage paid before monitoring takes place and interpret $w - \tilde{w} > 0$ as a

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

[2] 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, therefore leading to their own chosen values of p_L or p_H (see Easterbrook and Fischel (1991) on this flexibility).

penalty if the CEO is monitored. We look for an optimal contract within a class of contracts where the pair $(w, \tilde{w})$ satisfies $\tilde{w} = w - dy$. We will discuss the contract form in subsection 2.2 below.

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 $a = L$.[3]

CEO power is given by her reservation utility V: a CEO with power V only accepts a contract if by doing so she attains at least utility V. Note that with power utility, $V < 0$ for $\gamma > 1$ and $V > 0$ for $\gamma < 1$ since one may assume $V = \underline{c}^{1-\gamma}/(1-\gamma)$ for some reservation consumption $\underline{c} > 0$. 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 ability to change output, the ability to change governance, and CEO 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:

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

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

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 the board monitors the CEO, it can verify diversion $d_a y$ and the CEO is forced to return $d_a y = w - \tilde{w}$. Otherwise, she keeps the wage w.

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

[3] 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.

problem in the production stage, which is often studied in the standard textbook moral hazard model.

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 her 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 monitoring probability or monitoring intensity as the *effectiveness* of the firm's internal governance. Engaging in effort to change the probability of monitoring is thus equivalent to spending effort to change governance or its effectiveness. For example, effort could be spent by the CEO in developing creative accounting in an attempt to fool auditors or in filling the executive suite with her clones.

Under this interpretation, our assumption on 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, Coles and Terry (1994)). Another example is the willingness of CEOs to sell bonds offering 'change-of-control' clauses to bondholders. While they protect bondholders from leveraged buyouts that decrease the rating of the firm and can be justified to shareholders via a low cost of borrowing, 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 either poison pills or change-of-control covenants are beneficial to shareholders.

There are a variety of other rules, also not unambiguously bad (see Bebchuk 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.

The wage contract. As pointed out earlier, we may interpret the part w in the wage contract $(w, \widetilde{w})$ as the fixed wage paid before monitoring takes place. We could justify this interpretation by the following reasons: 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).[4] 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.

Our other assumption restricting the contracts we consider is that when CEOs are monitored they become liable for returning to shareholders the money diverted, hence $w - \tilde{w} = dy$. While this offers little controversy,[5] it is strengthened by the fact that the Sarbanes-Oxley Act asks that bonuses and other incentive compensation be forfeited due to earnings re-statement, 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, Karolyi, and Stulz (2004) and Doidge, et. al (2005) in the context of a controlling shareholder). 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. (2005) 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

[4] 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.

[5] A recent case is the court ruling requiring ex-HealthSouth CEO Richard Scrushy to return $48 million of performance-based bonuses, whether or not he was aware of the accounting fraud that inflated company earnings.

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 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, high probability of monitoring 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 she 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 to change governance.

3 Model Solution

To solve the optimal contracting problem (1), 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 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 monitored. The right hand side is the marginal cost. When the CEO is monitored, which occurs with probability p_a, she 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*

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

Then the CEO's optimal diversion rate is given by

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

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

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. The intuition is that when the CEO receives higher wages, she is more willing to take a larger gamble in diverting output. In other words, there is a complementarity between diversion and wages, establishing a positive correlation between the two.[6] Evidence of this complementarity can be

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

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

Straightforward differentiation yields (evaluated at the optimum d_a):

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

which is positive iff diversion is positive.

found in Johnson et al. (2005) 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. 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 (2005) 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-income 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 is low enough) relative to external governance. Our results do not need such strong requirement, but only that optimal diversion is positive in the high effort scenario $a = H$, so that it pays to spend effort to change governance. The condition that $\eta > 1$ is sufficient to ensure that the diversion rate is below 1 (given $y > w$). We assume (10) from now on. 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

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

summarizes the net-benefits of diversion in utility terms. 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.[7]

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

$$\max_w y - w - (1-p_L)\, d_L(w)\, y, \tag{15}$$

subject to (13)-(14). Here $d_L(w)$ is given by (9) for $a = L$.

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

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

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

[7] 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, she has less incentive to change governance since she 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 she has an incentive to change governance, violating the incentive constraint (21).

3.3 Implementing high effort

We now turn to implementing high effort level. As in the previous subsection, we use Lemma 1 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 $a = H$. 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 her 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 income 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.

Proposition 1 characterizes the optimal contract. It 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 Hellwig (2000) who defends that management actively pursues changes in the way their compensation and incentives are granted.

More formally, powerful CEOs with risk aversion $\gamma > 1$ and $V > V_1^*$ choose not to change governance since Lemma 5 shows that high effort to change governance cannot be implemented in the optimal contract. The intuition is that those CEOs avoid monitoring risk associated with diversion and exert their power by choosing high wage rates. They would rather be monitored more often, divert little, and get most of their income in the form of wages.

For CEOs with risk aversion $\gamma > 1$ and $V < V_1^*$, both high effort and low effort can be implemented by Lemmas 4-5. In an optimal contract, the board or shareholders will choose one of these effort levels to maximize shareholder value. The tradeoff is the following. Implementing a high effort level to change governance allows CEOs to divert more which lowers shareholder value. But it may be able to offer the CEOs a lower wage, which raises shareholder value. The net effect depends on the level of CEO power. Formally, there is a critical value $V_2^* < V_1^*$ such that it is optimal for the board to implement high effort to change governance if $V < V_2^*$, because these CEOs demand very low wages. For CEOs with intermediate power, $V_2^* < V < V_1^*$, it is optimal for shareholders to implement low effort and governance is not changed.

We now consider CEOs with low risk aversion $\gamma < 1$. For powerful CEOs with $V > V_1^*$, Lemma 4 shows that low effort cannot be implemented. Thus, it is optimal for the shareholders to allow for governance change. This occurs for two reasons: (i) with lower risk aversion the desired share of diversion income to wage pay is higher by Lemma 2; and (ii) a CEO with low risk aversion is also less concerned about income volatility implicit in $(w, \tilde{w})$ and the monitoring probabilities $(p_H, 1 - p_H)$. For less powerful CEOs with $V < V_1^*$, Lemmas 4-5 show that both high and low effort levels can be implemented. However, to maximize shareholder value, low effort level is optimal and governance is not changed.

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

Two recent papers using a new panel dataset from Credit Lyonnais Securities Asia (CLSA) on cross-country measurements of firm-level and country-wide governance show that good country-wide governance breeds good firm-level governance (Durnev and Kim (2005) and Klapper and Love (2004)). Regressing firm-level governance on country-wide legal rules they find a positive association after controlling for a range of firm and country effects.

The finding in Durnev and Kim (2005) and Klapper and Love (2004) is puzzling in light of the view that external governance in general 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) and Shleifer and Vishny (1997)).

LLSV (1998) argue that the quality of internal governance is dictated by the quality of external governance. They reason that from a legal point of view opting out of the legal standard is costly because enforcement of non-standard contracts is poor. In contrast, Easterbrook and Fischel (1991) 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 firm value increases with the level of internal governance even after controlling for country effects.

In our model we find that:

Proposition 2 *If $\gamma < 1$, good external legal governance breeds good internal governance in the sense that V_1^* increases with η.*

This result is surprising in our model, since we assume that external and internal governance are substitutes in limiting diversion. More of one should then reduce the need for the other.

The intuition for the result is that in the model better country-wide governance η discourages diversion and makes it easier to incentivize the CEO by Lemma 2. That is, when $\gamma < 1$ the firm can pay a higher wage to the CEO without unduly giving her 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.

When $\gamma > 1$ whether a positive relationship arises between external and internal governance is determined by the sign of $dV_2^*/d\eta$. When this derivative is negative, firms will less often accept internal governance changes if external governance improves, since Proposition 1 shows that only CEOs with $V < V_2^*$ change internal governance. There are two effects that determine the sign of this derivative. One is the same as before – diversion decreases with η. The other is that shareholders may offer low wages to low-power CEOs so that changing governance may occur. While we have not been able to determine the net effect analytically, we show that the first effect dominates using numerical examples 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 refer to the wave of firms announcing that they would voluntarily start to expense CEO options following Sarbanes-Oxley is consistent with this prediction.

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 *Improvements in external governance η lead to increases in wages if $\gamma < 1$ or if $\gamma > 1$ and either $V > V_1^*$ or $V < V_2^*$.*

The intuition for this result is the following. When the conditions in the proposition hold, then 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.

It is interesting to consider the case where $\gamma > 1$ and $V \in (V_2^*, V_1^*)$. In this case, the optimal wage is such that the incentive constraint binds. To determine the effect of η on the optimal wage, we have to determine its effect on not only the net benefit from diversion, but also the net benefit from change in governance $A_H - A_L$. We are not able to determine the latter effect analytically for general parameter values. However, in the appendix we prove that for sufficiently small $p_L - p_H > 0$, the optimal wage increases with η if and only if $\gamma > 1$ is large enough.

The intuition behind this result is the following. When p_H and p_L are sufficiently close, the net benefit from change in governance is small. For CEOs with sufficiently high risk aversion, this benefit is decreasing with η since these CEOs are hurt more by the monitoring risk. Thus, to incentivize these CEOs, shareholders must provide higher wages if η is higher. The opposite result holds for small values of $\gamma > 1$.

The prediction in proposition 3 is consistent with the much touted increase in CEO pay after Sarbanes-Oxley in 2002.[8] 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 (2003) 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 the wage rate is an increasing function of CEO power, *ceteris paribus*. The desired correlation

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

arises, because Proposition 1 also implies that high CEO power leads to worse governance if $\gamma < 1$. This proves that:

Proposition 4 *When $\gamma < 1$, changes in CEO power induce 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 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 (2005). 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.

From Proposition 4 we predict that the ratcheting effect in wages detected by Bizjak et al. (2003) 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 Building randomness in CEO hiring

Figure 1 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.

Figure 1 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. The randomization described below entails offering new contracts that leave the CEO

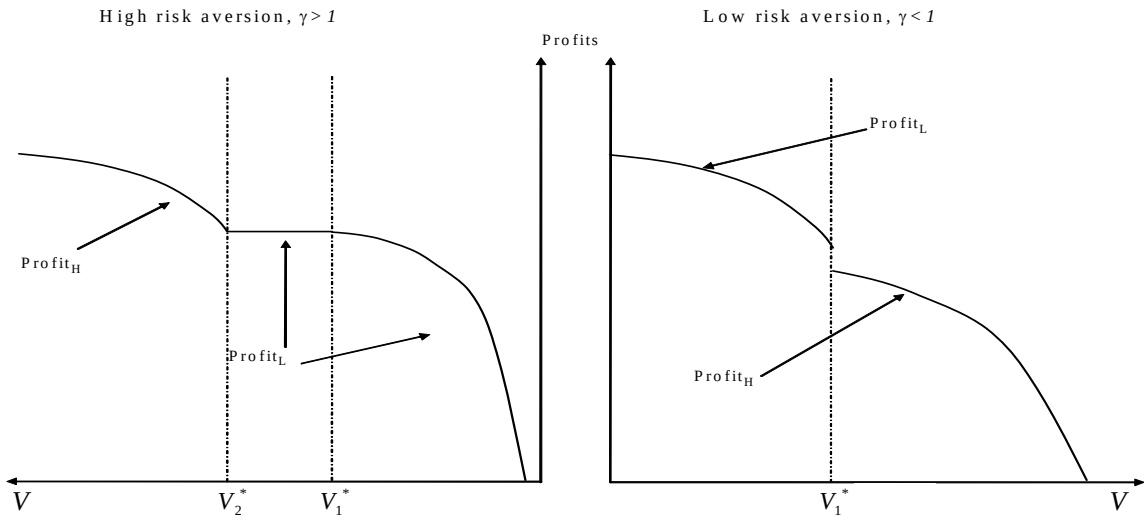

Figure 1: The figures plot the profit function when deterministic contracts are used. The left panel presents the case of high risk aversion, $\gamma > 1$, whereas the right panel presents the case of low risk aversion, $\gamma < 1$.

indifferent, but improve the welfare of the shareholders. While random contracts are rarely observed in reality, we offer a possible intuitive interpretation below.

Formally, these contracts, defined as power lotteries, are probability distributions over CEO power which solve the following problem:

$$\pi(V) = \max_{\alpha \in [0,1], V_L, V_H} (1-\alpha)\,\pi_L(V_L) + \alpha \pi_H(V_H) \tag{30}$$

subject to

$$(1-\alpha)\,V_L + \alpha V_H = V, \tag{31}$$

and the boundary conditions $V_L \in \{v : v \geq V_1^*, \pi_L(v) \geq 0\}$ and $V_H \leq V_2^*$ for $\gamma > 1$, and $V_L \leq V_1^*$ and $V_H \in \{v : v \geq V_1^*, \pi_H(v) \geq 0\}$ for $\gamma < 1$. A choice of α equal to either 0 or 1 entails prescribing a deterministic contract from Proposition 1. Instead, any choice of $0 < \alpha < 1$ implies that a stochastic contract is optimal.

The fact that α is not restricted to be either 0 or 1 means that the board may accept changes in governance that would otherwise not take place. This gives rise to two layers of board influence. One layer of influence is fully described by ex-ante CEO power V (Bebchuk et

al. (2002)). The other layer of influence, arising from the power lottery may confer the CEO with $V_H \geq V$. This additional layer of influence is value maximizing to shareholders.

Before we proceed to give the solution to problem (30), we motivate the use of power lotteries. We motivate power lotteries by considering an implementation that we view as realistic. The power lottery can be implemented by introducing randomness in the way preferences are aggregated within the board of directors. The randomness is determined endogenously via the CEO's extant power. A CEO that comes to the negotiation table with more power can steer the board into putting greater weight on her preferred subset of her own characteristics. She then faces better odds of coming out with her position reinforced. In contrast, CEOs with little extant power may be inquired about a broader set of characteristics, including many that are qualitative and prone to diverse judgements which more likely result in a loss of power to her. Examples of such qualitative characteristics are the various soft-skills of leadership.[9]

In this implementation, the choice of characteristics to be considered and the weight put on each of them determines the board's split into pro-candidate and contra-candidate. The board does not make decisions by majority voting, though the majority in the board has a bigger chance of winning. The randomness thus introduced is optimal if with some probability the CEO can be made to loose power; intuitively, the CEO looses political capital, her star status with the board, and influence.

Atkins (2004) acknowledges that at HealthSouth, where she was a board member, "Richard Scrushy was impressive and powerful" leaving less room for any board division. This would be a scenario where α is close to 1. She goes on to say: "We did a better job of *paying attention to the softer skills* at Lucent Technologies, where I was also a board member, when we decided to recruit Pat Russo" (our italics). The tone suggests a scenario of a power lottery with α much below 1. Similarly, Charan (2000) talks about evaluating "the total person," but that sometimes search committees fall for the "halo effect," evaluating candidates by the name of the company they come from.

Proposition 6 ***(CEO Power Lottery)*** *Suppose* $\gamma < 1$.[10] *Denoted the solution to to problem*

[9] Betsy S. Atkins (2004) commenting in *Chief Executive* on her tenure on the HealthSouth and Lucent Technologies board of directors, suggests using social interactions "to assess a candidate's passion and strength of convictions" and asking open-ended questions such as what the candidate is proudest in his/her career, or what was the most difficult challenge faced.

[10] We relegate the solution for $\gamma > 1$ to the appendix.

(30) by (α^*, V_L^*, V_H^*)*. There are two cases:*

1. *If* $\underline{V} \in (0, V_1^*)$ *and* $\overline{V} \in (V_1^*, V_0^*)$*, then (i) for* $V < \underline{V}$*, we have* $\alpha^* = 0$*,* $V_L^* = V$*, and* $\pi(V) = \pi_L(V)$*; (ii) for* $V > \overline{V}$*, we have* $\alpha^* = 1$*,* $V_H^* = V$*, and* $\pi(V) = \pi_H(V)$*; and (iii) for* $V \in [\underline{V}, \overline{V}]$*, we have*

$$\alpha^* = \frac{V - \underline{V}}{\overline{V} - \underline{V}}, \quad V_L^* = \underline{V}, \quad \text{and } V_H^* = \bar{V}. \tag{32}$$

2. *If* $\underline{V} > V_1^*$*, then define* $\underline{V}' = V_1^*$ *and* $\overline{V}'$ *as the unique solution to*

$$\max_{v \leq V_0^*} \frac{\pi_H(v) - \pi_L(V_1^*)}{v - V_1^*}. \tag{33}$$

The solution is as above substituting $\left(\underline{V}', \overline{V}'\right)$ *for* $\left(\underline{V}, \overline{V}\right)$*. The appendix gives the definition of the constants* $\underline{V}, \overline{V}, \psi$*, and* V_0^**.*

Figure 2 depicts case 1 in Proposition 6 for CEOs with $\gamma < 1$ (right side panel) and a similar case for CEOs with $\gamma > 1$ (left side panel). Consider first the right side picture of low risk aversion. There is an intermediate range of CEOs for which the board optimally splits giving rise to the power lottery. The likelihood of a favorable outcome to the CEO from the board, α^*, is an increasing function of ex-ante CEO power. For these intermediate power levels, Figure 2 shows that there is a range of CEO power BE where shareholders concede a chance for governance change where if only deterministic contracts were allowed no such possibility would arise.

If the CEO is a star CEO with significant power she always spends the effort to change governance and the board has to accept the changes in order to retain her. Therefore, powerful CEOs are associated with firms with weaker internal governance. On the other extreme, the less powerful CEOs cannot convince the board to change governance and are paid a wage rate that makes the status quo governance level incentive compatible.

With high risk aversion (left panel) there is also an intermediate range of CEO power where the power lottery is optimal. Outside this range, the firm offers only deterministic contracts. CEOs with power in the range CV_2^* face a probability of loosing power, which places them at point B. Here, they opt to spend effort to change governance. However, CEOs with power in the range CV_2^* would never change governance if only deterministic contracts were allowed.

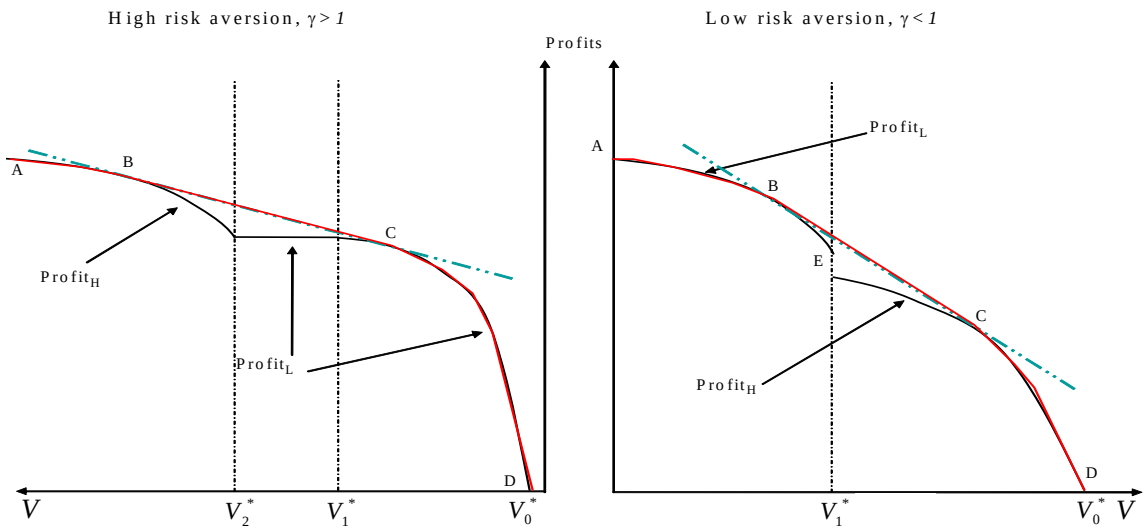

Figure 2: The figures plot the profit function when stochastic contracts are used. The left panel presents the case of high risk aversion, $\gamma > 1$, whereas the right panel presents the case of low risk aversion, $\gamma < 1$. The envelope comprised of the curve [ABCD] gives the profit function.

6 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 Hellwig (2000). This sets the agency conflict on the choice of governance between CEOs and shareholders. The model highlights the role of managerial risk aversion in the pursuit of private benefits and the weakening of governance. 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. 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

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

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

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

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),

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

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

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

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

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

Proof of Proposition 2: The result follows because the threshold level 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. Calculus gives

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

which is negative iff $\gamma < 1$. Since $\frac{\partial V_1^*}{\partial \eta}$ varies indirectly with $\frac{\partial (A_H / A_L)}{\partial \eta}$ we get the desired result. ■

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

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

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 now the case of $\gamma > 1$. 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.

Now consider the case where $\gamma > 1$ and $V_2^* < V < V_1^*$. Since the optimal wage is given by (19), it increases with η if and only if $\partial A_H/\partial\eta < \partial A_L/\partial\eta$. With $p_L - p_H > 0$ small this inequality is equivalent to $\partial^2 A_a/\partial\eta\partial p_a > 0$. Using (A.11) this derivative is

$$\begin{aligned}\frac{\partial^2 A_a}{\partial\eta\partial p_a} &= -(1-\gamma)\frac{A_a}{1+\eta}\frac{dq_a}{dp_a} - (1-\gamma)\frac{q_a}{1+\eta}\frac{dA_a}{dp_a} \qquad \text{(A.12)}\\ &= (\gamma-1)A_a\frac{\left(\left(\frac{\eta p_a}{1-p_a}\right)^{-1/\gamma}-1\right)\left(1-\left(\frac{\eta p_a}{1-p_a}\right)^{(\gamma-1)/\gamma}\right)-\frac{1+\eta}{\gamma}\frac{1}{1-p_a}\left(\frac{\eta p_a}{1-p_a}\right)^{-1/\gamma}}{p_a(1+\eta)\left(1+\eta\left(\frac{\eta p_a}{1-p_a}\right)^{-1/\gamma}\right)^2}.\end{aligned}$$

The term in the numerator above is negative for γ close to 1 and positive for γ sufficiently large. Hence, for sufficiently large (small) $\gamma > 1$, pay increases (decreases) for these CEOs as well. ■

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. ■

Proof of Proposition 6: Let χ be the Lagrange multiplier associated with (31). We ignore all other constraints for now and derive first-order conditions as follows:

$$\pi_L(V_L) - \pi_H(V_H) + \chi(V_L - V_H) = 0, \qquad \text{(A.13)}$$

$$\alpha\pi_L'(V_L) + \alpha\chi = 0, \qquad \text{(A.14)}$$

$$(1-\alpha)\pi_H'(V_H) + (1-\alpha)\chi = 0. \qquad \text{(A.15)}$$

Solving these equations, we obtain the solution described in equation (32).

We define the values

$$\underline{V} \equiv \frac{\psi}{\gamma(1-\psi)}k \text{ and } \overline{V} \equiv \frac{1-\gamma(1-\psi)}{\gamma(1-\psi)}k, \qquad \text{(A.16)}$$

where

$$\psi \equiv \left(\frac{1+(1-p_H)q_H}{1+(1-p_L)q_L}\right)^{\frac{1-\gamma}{\gamma}}\left(\frac{A_L}{A_H}\right)^{\frac{1}{\gamma}}. \qquad \text{(A.17)}$$

Also define

$$V_0^* \equiv \left(\frac{y}{1+(1-p_H)q_H}\right)^{1-\gamma}\frac{A_H}{1-\gamma} - k, \qquad \text{(A.18)}$$

which satisfies $\pi_H(V_0^*) = 0$.

If the conditions in part (1) are met, then equation (32) gives the solution to problem (30).

If the conditions in part (1) are not met, we claim that $\underline{V} > V_1^*$. From Figure 2, we observe that if an interior solution does not exist, then $\pi'_L(V_1^*) > \pi'_H(V_1^*)$, where $\pi_L(V)$ and $\pi_H(V)$ are given by (18) and (26), respectively. The preceding inequality is equivalent to $V_1^* < \psi k/(1-\psi)$. Since

$$\underline{V} = \frac{\psi k}{\gamma(1-\psi)} > \frac{\psi k}{1-\psi} = V_1^*, \tag{A.19}$$

we have proved the preceding claim. For part (2), where $\underline{V} > V_1^*$, define the new 'contact' points $\underline{V}' = V_1^*$ and $\overline{V}'$ to be the unique solution to (33). This problem admits a unique solution. If there is an interior solution, $\overline{V}'$ solves

$$\pi'_H\left(\overline{V}'\right)\left(\overline{V}' - V_1^*\right) - \left(\pi_H\left(\overline{V}'\right) - \pi_L(V_1^*)\right) = 0, \tag{A.20}$$

otherwise $\overline{V}' = V_0^*$. Intuitively, $\overline{V}'$ is obtained by tracing the line with the highest slope that goes through $(V_1^*, \pi_L(V_1^*))$ and is tangent to $\pi_H(V)$, unless at that point $\pi_H < 0$. In this solution (i) if $V < \underline{V}'$ then $\alpha^* = 0$ and $V_L^* = V$, (ii) if $V > \overline{V}'$, $\alpha^* = 1$ and $V_H^* = V$, and (iii) if $\underline{V}' < V < \overline{V}'$, then $\alpha^* = \frac{V-\underline{V}'}{\overline{V}'-\underline{V}'}$, $V_L^* = \underline{V}'$ and $V_H^* = \overline{V}'$.

We now turn to the case where $\gamma > 1$. We can similarly show there are two cases. In the first case, there are two tangency points:

$$\underline{V} = \frac{1+(\psi-1)\gamma}{(\psi-1)\gamma}k,\ \overline{V} = \frac{1+2(\psi-1)\gamma}{(\psi-1)\gamma}\psi k, \tag{A.21}$$

with $\underline{V} < \overline{V} < 0$. In the second case, which occurs, if and only if, $\overline{V} < V_1^*$, we define the new 'contact' values to be: $\overline{V}' = V_1^*$ and $\underline{V}'$ is the unique solution to the problem

$$\min_{v \le V_2^*} \frac{\pi_L(V_1^*) - \pi_H(v)}{V_1^* - v}. \tag{A.22}$$

Given these 'contact' points, the value of $\alpha^* = \frac{\overline{V}-V}{\overline{V}-\underline{V}}$. To save space, we omit the detailed characterization.

Finally, note that for any γ, the concavity of $\pi(V)$ is guaranteed by construction. ■

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:

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

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

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

and the board's optimization problem yields:

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

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 $\log A_0 \leq -k + \log A_1$, 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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