Incentives for CEOs to Make Decisions That May Cost Them Their Jobs*

Roman Inderst† Holger M. Müller‡

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Abstract

We ask how CEOs should be optimally compensated to make value-maximizing decisions that may cost them their jobs. Examples are the decision to shut down the firm, to give up resistance against a sale or takeover, or to acknowledge failure of the firm's current business strategy, thus allowing the board to hire a new CEO with a different managerial vision. We find that the CEO's optimal compensation package consists of cash, options grants, and severance pay. As opportunities to reallocate firm assets become more valuable, shareholders must cede substantial rents to the CEO in the form of more valuable option grants and severance pay. Restrictions on either the size or the form of the CEO's pay may destroy value and impede efficient reallocations of assets across industries.

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†INSEAD, London School of Economics, and CEPR. Address: INSEAD, Department of Finance, Boulevard de Constance, 77305 Fontainebleau Cedex, France. Email: roman.inderst@insead.edu.

‡New York University and CEPR. Address: Department of Finance, Stern School of Business, New York University, 44 West Fourth Street, Suite 9-190, New York, NY 10012. Email: hmueller@stern.nyu.edu.

1 Introduction

CEOs may arguably be reluctant to make decisions that cost them their jobs, even if such decisions are in the best interest of shareholders and the firm as a whole.

An example is the decision to shut down the firm. Jensen (1993) cites the reluctance of CEOs to liquidate firms as one of the main difficulties in responding to what he calls the "Modern Industrial Revolution": "Even when managers do acknowledge the requirement for exit, it is often difficult for them to accept and initiate the shutdown decision. For the managers who must implement these decisions, shutting plants or liquidating the firm causes personal pain, creates uncertainty, and interrupts or sidetracks careers. Rather than confronting this pain, managers generally resist such actions" (p. 848). In a similar vein, Murphy (1997) argues that managers "too easily dismiss exit as an appropriate long-run strategy" for fear that they will "be managing themselves out of a job" (p. 422).

Another, well-known example is managerial resistance against takeovers. Agrawal and Walking (1994), Hadlock, Houston, and Ryngaert (1999), and Hartzell, Ofek, and Yermack (2004) find that in a majority of cases, CEOs lose their jobs after a takeover. Both liquidation and takeovers are examples in which the CEO's loss of job goes hand in hand with a reallocation of the firm's assets. More generally, however, the CEO may lose his job because he is replaced by a new CEO with a different vision and business strategy, i.e., by someone with a different idea of how to put the firms' assets to their highest-yield use.[1] Evidence from the management literature suggests that fundamental changes in a firm's strategy are often preceded by a replacement of the firm's top management (e.g., Gordon et al. (2000), Kesner and Dalton (1994)). Similarly, Weisbach (1995), Denis and Denis (1995), Huson, Malatesta, and Parrino (2003), and Clayton, Hartzell, and Rosenberg (2003) find evidence consistent with the notion that CEO replacements tend to be associated with subsequent changes in firm strategy.

This paper asks how to (optimally) overcome the CEO's reluctance to make decisions that may cost him his job, e.g., to shut down the firm, give up resistance against a sale or takeover, or admit that his business strategy is not working, thus giving the board the opportunity to replace

[1] Why not simply order the incumbent CEO to change his strategy? Several authors argue that CEOs are hired for their unique vision and style (e.g., Bertrand and Schoar (2003)), implying that a change in the firm's strategy may require hiring a new CEO with a different style. Relatedly, Rotemberg and Saloner (1993) argue that in order to credibly communicate a new strategy "down the line", a firm may have to replace its old CEO.

him with a new CEO using a different strategy. We begin by asking why shareholders do not simply force the CEO to take the right action? Our answer is that shareholders may not have enough information. The CEO is likely to know more about the firm's current business strategy than shareholders, and also where the firm is headed if the status quo is preserved. Forcing the CEO, absent sufficient information to make a good decision, may be the wrong choice. Along these lines, Jensen (1993, p. 864) argues that "the CEO most always determines the agenda and the information given to the board. This limitation on information severely hinders the ability of even highly talented board members to contribute effectively to the monitoring and evaluation of the CEO and the company's strategy".

The CEO in our model is biased against decisions that may cost him his job as his expected compensation if he continues under the status quo exceeds that from alternative employment—a features that arises endogenously in our model. Both Fee and Hadlock (2004) and Hartzell, Ofek, and Yermack (2004) document substantial losses of pecuniary benefits for CEOs who must leave.

The CEO's optimal compensation scheme thus solves a nontrivial problem: it must align the CEO's incentives with that of shareholders, and it must harness the CEO's superior knowledge to make efficient decisions. We solve this problem by adopting a general mechanism-design approach. The optimal mechanism takes a simple form: shareholders fully delegate the decision-making to the CEO while his compensation package is carefully chosen to align his incentives and minimize his informational rents. The uniquely optimal compensation package consists of severance pay, options, and a cash component.

The role of severance pay in our model is straightforward: without adequate compensation, the CEO will never make a decision that may cost him his job (see Almazan and Suarez (2003)). But severance pay is only one side of the coin. The other is the CEO's compensation if he continues under the status quo, i.e., if he resists a possible liquidation, sale, or change of business strategy, arguing that the firm is doing fine under his strategy and leadership. Option pay inflicts the maximum possible punishment (subject to limited liability constraints) on a CEO making the wrong decision: it rewards him genereously if the firm is doing well, but it *minimizes* his performance pay if the firm is doing poorly.[2] Based on this rationale, any form of variable pay is better than fixed pay. Option pay is uniquely optimal, however, as it leaves the CEO with

[2]The role of the cash component is to provide the CEO with a minimum consumption level in these states.

less in case of poor performance than, say, stock grants. If the CEO believes the firm is doing poorly, he is thus more likely to "pull the plug" and take his severance pay.[3]

As new opportunities to reallocate assets into other industries open up, the (opportunity) cost of continuing under the status quo rises. In this case, our model implies that the total value of the CEO's compensation package increases, whereby the increase is accomplished by increasing both the value of the option grant and the severance pay. Over the last two decades, firms have faced growing opportunities to adopt new technologies, to capture market shares in newly deregulated markets, and to redefine their businesses by entering into entirely new industries.[4] The 1980s and 90s also witnessed fundamental changes in executive pay practices. According to Hall and Liebman (1998), at the beginning of the 1980s, CEO compensation was mainly in the form of cash salary and bonuses, whereas by 1994 new option grants had been awarded to 70% of CEOs in the U.S., with the average CEO receiving options with a Black-Scholes value of $1.2 million.[5] Equally striking is the sharp increase in the level of executive pay over the last two decades, with the median compensation rising from about $1 million in 1980 to $7 million in 2001 (in 2001 dollars), an increase of nearly 600% (Hall and Murphy (2002)). Our argument that shareholders may voluntarily cede higher rents to managers in response to new opportunities to reallocate assets, and that this is accomplished by giving away more valuable option grants, is consistent with these developments.

As we have already said earlier, the role of severance pay in our model is consistent with its use in other models (e.g., Almazan and Suarez (2003)).[6] Our argument that option grants are optimal ways to induce CEOs to reveal their private information, thus allowing efficient exit or replacement decisions, is—to the best of our knowledge—new. The extant literature on CEO incentive pay has suggested alternative roles, e.g., to motivate managers to work hard (Holmstrom (1979)) or take on risks (Lambert (1986)), to select more able managers (Lazear

[3] Consistent with our argument, Mehran, Nogler, and Schwartz (1997) find that CEO stock ownership and stock options have a positive effect on the likelihood of voluntary liquidation. Dial and Murphy (1995) document the case of General Dynamic's partial liquidation, arguing that executives' incentive plans were sufficiently large to motivate them to sell off assets, thereby sacrificing even their own positions.

[4] The long stock market booms of the 1980s and 1990s may have been a reflection of these new opportunities, while the merger and takeover waves during the same period may have been a reflection of the ensuing need to reallocate assets (e.g., Andrade, Mitchell, and Stafford (2001)).

[5] See Murphy (1999) for a review of the facts and literature.

[6] See also Knoeber (1986), Jensen (1988), Harris (1990), and Berkovitch and Khanna (1991).

(1999)), or to affect the strategic interaction on the product market (Aggarwal and Samwick (1999)).[7] Finally, attempts have been made to explain the recent increase in the level of top management compensation (Murphy and Zabonjnik (2003), Himmelberg and Hubbard (2000), and Hermalin (2003)). We will discuss these contributions later.

The rest of this paper is organized as follows. Section 2 presents the model. Section 3 derives the CEO's optimal compensation package. Section 4 discusses the implications of exogenous restrictions on the CEO's compensation package and examines the effect of a change in the value of reallocating assets. Section 5 concludes. All proofs are in the Appendix.

2 The Model

There are three periods of time, $t = 0, 1, 2$. For simplicity, payoffs are not discounted and all agents are risk neutral. At $t = 0$, a firm's owners hire a manager to run the firm. The manager chooses the firm's strategy and must undertake some privately costly action to make his strategy work. It is convenient to refer to the manager's action simply as his effort. At $t = 1$, the manager learns some information about how profitable it is to continue operating the firm's assets under his strategy. At this point, owners may also choose an alternative opportunity, e.g., to liquidate or sell the firm, in which case the manager may lose his job. If the firm is continued under its current management (and strategy), it is convenient to suppose that the firm is ultimately liquidated or sold in the next period, $t = 2$, which is also the time when the manager retires. We next flesh out the various components of the model.

If the firm is continued until $t = 2$, its final value (or share price, in case it is publicly traded) equals $s \in S = [\underline{s}, \overline{s}]$. At $t = 0$, the common beliefs about s—provided the manager will not shirk—are given by the distribution function $G(s)$, which is atomless and has the everywhere strictly positive density $g(s)$. The manager, who runs the company, receives some additional information at $t = 1$. It is convenient to refer to this information as the (interim) state at $t = 1$, which we denote by $\theta \in \Theta = [\underline{\theta}, \overline{\theta}]$ and which is only privately observed by the manager.

[7] Another strand of the literature explains the use of *broad-based* stock and option grants given to the firm's rank-and-file instead of the CEO. For instance, Oyer (2003) shows that equity-linked pay can be an effective instrument to retain employees, Bergman and Jenter (2003) argue that it can be used to exploit employees' optimism, and Inderst and Müller (2003) argue that it can mitigate distortions if the firms is managed solely in the interest of shareholders instead of all its stakeholders.

A priori, the common beliefs over the realization of θ are given by the distribution function $F(\theta)$, which is atomless and has the everywhere strictly positive density $f(\theta)$. After observing θ, the manager's updated beliefs about the firm's value in $t = 2$ are given by the distribution function $G_\theta(s)$, which is again atomless and has the everywhere strictly positive density $g_\theta(s)$.[8] We assume that $g_\theta(s)$ is continuous in both θ and s. Higher states represent "good news" in the sense of the Monotone Likelihood Ratio Property (MLRP). That is, $g_{\theta'}(s)/g_\theta(s)$ is strictly increasing in s for all $\theta' > \theta$ in Θ.

At $t = 1$, owners can also opt for a radical change. The key feature of this change is that it may cost the manager's job. In the Introduction we provided a number of examples for such a fundamental change, including the liquidation or the sale of the firm or the reorganization of its strategy and businesses. In what follows, we will simply refer to owners' alternative as their *outside opportunity.* The expected value of the owners' outside opportunity is given by $P > 0$ and we specify for simplicity that the manager will lose his job with probability one in case the outside opportunity is realized. For simplicity, we set the manager's income from alternative employment equal to zero.[9]

It is now convenient to define already at this stage the *efficient* decision rule in $t = 1$. It is efficient to choose the outside opportunity if $E[s \mid \theta] := \int_S s g_\theta(s) ds < P$ and to continue with the existing strategy (and management) if $E[s \mid \theta] > P$. As $g_\theta(s)$ is continuous in θ for all s and as it satisfies MLRP, which implies First-Order Stochastic Dominance, we have that $E[s \mid \theta]$ is continuous and strictly increasing in θ. Hence, unless it is efficient to always sell or to never sell, there exists a first-best threshold $\underline{\theta} < \theta_{FB} < \overline{\theta}$ defined by $E[s \mid \theta_{FB}] = P$, such that it is more efficient to sell if $\theta < \theta_{FB}$ and more efficient to let the manager continue if $\theta > \theta_{FB}$.

The decision problem in $t = 1$ is now reflected in the mechanism that owners set up to remunerate (and incentivate) the manager. We take a general message-game approach. Appealing to the revelation principle, the mechanism specifies for each state $\theta \in \Theta$ a decision rule and a respective payment to the manager. For all $\theta \in \Theta_+ \subseteq \Theta$, the firm is continued under the current strategy and management, in which case the manager receives the wage $w(s, \theta)$ in $t = 2$. Note

[8] Of course, by Bayesian updating it must hold that $g(s) = \int_S g_\theta(s) f(\theta) ds$.

[9] If the CEO is close to retirement he may in fact not be willing (or able) to seek new employment. Agrawal and Walkling (1994) find that the majority of CEOs of an acquired company do not work as senior executives of a public company within three years of the acquisition.

that the wage can condition on the firm's (stochastic) value in $t = 2$.[10] For the complementary set of states $\Theta_- = \Theta \backslash \Theta_+$, the owners realize their outside opportunity and the manager receives a payment $W(\theta)$.

We have so far remained silent on the manger's incentive problem in $t = 0$. Exerting effort comes at the private disutility $c > 0$. Whether the manager has exerted effort or not is only observable if the firm is continued under his management until $t = 2$, in which case it is, however, fully revealed. Consequently, it is optimal that the manager foregoes any payment in $t = 2$ if he was caught shirking. We further assume that it is always optimal for owners to incentivate the manager to exert effort.[11] The managerial effort problem is admittedly very simple. In fact, given that the manager's action is perfectly observable at $t = 2$ the model without the decision problem at $t = 1$ would generate a plethora of optimal "forcing" contracts, each ensuring that the manager undertakes effort and receives zero rents.[12] Essentially, the role of the incentive problem in $t = 1$ is thus solely to ensure that the manager obtains a rent inside the firm, which makes the decision problem in $t = 1$ non-trivial.

3 The Optimal Compensations Scheme

3.1 The Owners' Problem

The owners' choice variables are the sets of states Θ_+ and Θ_- and the respective compensation schemes $W(\theta)$ for $\theta \in \Theta_-$ and $w(s, \theta)$ for $\theta \in \Theta_+$. We assume that it is optimal for owners that

[10] By making $w(s, \theta)$ dependent on θ, we do not suppose that the mechanism can directly condition on θ. As usual, it can only condition on the manager's *message* θ. Note also that for convenience s denotes the value of the firm before deducting the manager's pay.

[11] This condition could be easily formalized by specifying that the continuation payoff is sufficiently increased by exerting effort.

[12] If the state was verifiable, the optimal mechanism would prescribe to sell the firm if and only if $\theta \leq \theta_{FB}$, while *one* optimal compensation scheme is to pay the manager the fixed wage $w = c/[1 - F(\theta^*)]$ in case the firm was continued and the manager was not caught shirking.

both Θ_+ and Θ_- are non-empty.[13] Owners maximize expected profits

$$\int_{\Theta_-} [P - W(\theta)] f(\theta) d\theta + \int_{\Theta_+} E[s - w(s,\theta) \mid \theta] f(\theta) d\theta \tag{1}$$

subject to a set of constraints, which is described next. First, the owners' choice is constrained by the manager's *truthtelling constraint* in $t = 1$. The first implication of this is that for all $\theta \in \Theta_-$ we must have $W(\theta) = W$. Otherwise, the manager would always claim that the state of nature is $\theta \in \arg\max_{\theta' \in \Theta_-} W(\theta')$ when revealing that the outside opportunity should be chosen. Note that $W = W(\theta)$ comprises all the manager receives when leaving the firm in $t = 1$. In practice, this may include, for instance, additional cash payments such as "golden parachutes" in the case of an acquisition or additional pension benefits.[14]

In what follows, it is convenient to simply refer to W as the manager's severance pay. The manager truthfully reveals that $\theta \in \Theta_-$ if

$$W \geq \max_{\theta' \in \Theta_+} E[w(s,\theta') \mid \theta], \tag{2}$$

where the right side equals the maximum payoff he would get from announcing a state $\theta' \in \Theta_+$, where he leaves the firm. Likewise, for all $\theta \in \Theta_+$ truthtelling requires that

$$E[w(s,\theta) \mid \theta] \geq \max \left\{ W, \max_{\theta' \in \Theta_+} E[w(s,\theta') \mid \theta] \right\}. \tag{3}$$

That is, truthtelling must be (weakly) preferred both to announcing another state where the manager continues and to revealing that the outside opportunity should be chosen.

The next constraint is the manager's *incentive constraint* at $t = 0$. Provided that the truthtelling requirements (2) and (3) hold, the manager expects to receive the payoff

$$\int_{\Theta_+} E[w(s,\theta) \mid \theta] f(\theta) d\theta + \int_{\Theta_-} W f(\theta) d\theta - c \tag{4}$$

[13] This can be made endogenous by ensuring that for low realizations of θ the outside opportunity is more profitable and for high θ it is much better to continue with the current management and strategy, while $F(\theta)$ puts sufficient mass on both low and high states.

[14] Hartzell et al. (2004) document the various forms of benefits received by CEOs of acquired firms. They report mean benefits of \$8 to \$11 million. Yermack (2004) analyzes more generally the size and form of CEOs' severance payments. He finds that almost 80% of leaving CEOs receive separation pay, much of it in the form of lump-sum payments or pension augmentations. Unless the former CEO remains affiliated with the firm, e.g., as a member of the board, accelerating vesting provisions allow the CEO to recoup some value from existing stock or option plans while all other rights are forfeited. (See also Mehran et al. (1997) for similar provisions in case of an outright liquidation.)

when exerting effort. If he shirks it is optimal to subsequently announce $\theta \in \Theta_-$ and to leave the firm with a payoff of W. Comparing this to (4) and rearranging terms, we have the incentive constraint

$$\int_{\Theta_+} E[w(s,\theta) - W \mid \theta] f(\theta) d\theta \geq c. \tag{5}$$

In words, to incentivate the manager there must be a sufficiently large wedge between what he earns if he continues to run the firm and what he receives if he leaves the firm.

We finally impose additional constraints on the choice of the compensation scheme. We stipulate that the manager must always realize at least the wage $C \geq 0$, which represents a *minimum consumption level.*[15] As we assume that the manager has zero initial wealth, this requires that $w(s,\theta) \geq C$ for all $s \in S$ and $\theta \in \Theta_+$.[16] Our final constraint is on the slope of the compensation schemes $w(s,\theta)$. We stipulate that from any increase $s' - s$ of the final firm value owners must at least obtain the share $\delta(s' - s)$, where $0 \leq \delta < 1$. One justification is that, otherwise, owners or their representatives would have too much of an incentive to extract value from the firm just before $t = 2$, e.g., by selling assets below value to an affiliated company. Alternatively, for public companies δ may arise from boards' fear of having to justify compensation packages that were (ex-post) excessively generous. As long as shareholders' own gains, i.e., $(1 - \delta)(s' - s)$, are sufficiently large, boards feel protected.

Our approach to solve the owners' problem is now as follows. We first solve a *restricted* problem where we stipulate that owners can only offer a *single* wage contract $w(s,\theta) = w(s)$ for all $\theta \in \Theta_+$. Naturally, this heavily simplifies our analysis. We subsequently show that this restriction is without loss of generality as offering a single wage *strictly* dominates any (non-degenerate) menu.

3.2 Solving the Owners' Restricted Problem

The decision rule owners can implement is restricted by the manager's truthtelling constraint. Recall now that we first solve the restricted problem where a single wage contract $w(s)$ is offered. It also proves to be useful to show first that we can rule out flat wage schemes where $w(s) = w$ holds for all $s \in S$. To make the manager truthfully reveal both $\theta \in \Theta_+$ and $\theta \in \Theta_-$ under a

[15] More formally, we may think of the manager as becoming infinitely risk averse as his payoff reaches the boundary C.

[16] The requirement $W \geq C$ will not bind due to the "wedge" created by (5).

flat wage, he must be made indifferent such that $W = w$. But then the incentive constraint (8) can not hold. (Formally, (8) transforms to $\int_{\Theta_+}(w - W)f(\theta)d\theta = 0 \geq c$, which is not satisfied as $c > 0$.)

Lemma 1. *It is not feasible to choose a flat wage, i.e., to set $w(s) = w$ for all $s \in S$.*

As $w(s)$ is thus strictly increasing for some $s \in S$ (and as it is everywhere nondecreasing), the expected wage $E[w(s) \mid \theta]$ is strictly increasing for all θ. As $E[w(s) \mid \theta]$ is also continuous due to the continuity of all $g_\theta(s)$ and as both Θ_- and Θ_+ are non-empty, we have the following result from the truthtelling constraints (2) and (3).

Lemma 2. *There exists a threshold θ^* such that $\Theta_- = [\underline{\theta}, \theta^*]$ and $\Theta_+ = [\theta^*, \overline{\theta}]$, i.e., the firm is sold if and only if θ is sufficiently low. At the threshold θ^* the manager is just indifferent between the two alternatives:*

$$E[w(s) \mid \theta^*] = W. \tag{6}$$

It will sometimes be convenient to explicitly denote the dependency of θ^* on the contract by writing $\theta^*(w, W)$. For all $\theta < \theta^*$ the manager strictly prefers that owners take their outside opportunity, while he strictly prefers to continue managing the firm for all $\theta > \theta^*$. At $\theta = \theta^*$, which is a zero-probability event, the manager is indifferent between the two alternatives. Owners can thus simply implement the optimal mechanism by fully delegating the decision to the manager.

With the help of Lemma 2, it is now convenient to rewrite the owners' restricted program. Owners choose a pair (w, W) to maximize

$$F(\theta^*)(P - W) + \int_{\theta^*}^{\overline{\theta}} E[s - w(s) \mid \theta]f(\theta)d\theta \tag{7}$$

subject to the incentive constraint

$$\int_{\theta^*}^{\overline{\theta}} E[w(s) - W \mid \theta]f(\theta)d\theta \geq c, \tag{8}$$

the constraint that θ^* solves (6), and the requirement that $w(s) \geq C$ holds for all $s \in S$. It follows by standard arguments that the incentive constraint (8) binds at an optimum. Substitution into (7) yields for the owners' objective function

$$[1 - F(\theta^*)]\, P + \int_{\theta^*}^{\overline{\theta}} E[s \mid \theta]g_\theta(s)ds - c - W, \tag{9}$$

while the manager's payoff (net of his disutility from exerting effort) is W. Note that the manager can extract a *rent* equal to the size of his severance pay. Intuitively, following an increase in W owners must also sufficiently raise the manager's compensation if he continues to run the firm in order to still satisfy the incentive constraint (8).[17] The owners' expected payoff is equal to expected profits, given the decision rule θ^*, minus the costs of effort c and the manager's rent W.

Lemma 3. *The owners' expected profits are given by (9), while the manager realizes rents equal to his severance pay, W.*

Setting $W > 0$ and thereby allowing the manager to extract rents is *necessary* to induce truthtelling. This follows as the wedge between the manager's expected compensation within the firm and his outside opportunity creates a bias against selling the firm and losing his job. Formally, as $E[w(s) \mid \theta]$ is strictly positive for all θ in case the incentive constraint is satisfied, the manager would for $W = 0$ always prefer *not* to sell the firm.

By Lemma 3, owners face a trade-off between ensuring that a more efficient decision rule is chosen, i.e., a decision rule θ^* that is closer to the first-best rule θ_{FB}, and restricting the rent that is left to the manager. Our key finding is that in order to implement a given threshold θ^* at least costs to owners, it is uniquely optimal to compensate the manager with a combination of an option and a cash component.

Lemma 4. *To implement a given decision rule θ^*, the uniquely optimal wage scheme is to set $w(s) = C$ for $s \leq \widehat{s}$ and $w(s) = C + \delta(s - \widehat{s})$ for all $s > \widehat{s}$, where $\underline{s} < \widehat{s} < \overline{s}$.*

Proof. See Appendix.

To understand the intuition for Lemma 4, it is convenient to first suppose that $C = 0$. (That is, the manager's minimum consumption requirement is zero.) It is then uniquely optimal to compensate the manager with an option on the firm's value in $t = 2$: $w(s) = \max\{0, (1 - \delta)(s - \widehat{s})\}$. This compensation strategy shifts the manager's expected compensation as much as possible into high s, subject to the constraint that the slope of $w(s)$ does not exceed $1 - \delta$. Recall now that for higher states θ the firm value in $t = 2$ is likely to be higher, while following

[17] Interestingly, Yermack (2004) finds that the size of CEOs' separation pay is indeed strongly positively correlated with the expected future compensation within the firm. Likewise, Lefanowicz et al. (2000) find that managers whose contracts prescribe generous parachutes are typically more highly compensated.

low states θ the firm value is likely to be low. Consequently, option pay earns the manager a fortune for high θ, which is, however, inconsequential as for high θ he would (and *should*) anyway prefer to continue to manage the firm's assets. In contrast, option pay severely reduces his compensation for low θ, making it more preferable to leave the firm and let owners realize their outside opportunity. Hence, option pay affects the manager's preferences and thus his decision in precisely those states where it matter, i.e., after low realizations of θ where it is not efficient that he continues to manage the firm. This allows to implement a given decision rule θ^* at the lowest possible costs to owners. For $C > 0$, owners must pay in addition a flat wage, which is optimally chosen to be just equal to the required minimum consumption level C.

By increasing W and adjusting $w(s)$ accordingly in order to still satisfy the incentive constraint (8), owners can achieve a more efficient decision rule θ^*. It is worthwhile to bring out clearly why this is the case. To satisfy the incentive constraint (8), any increase in W must be matched with a higher value of the option. Importantly, the resulting increase in the wage $w(s)$ thus takes place overproportionally at high values of s. Consequently, the difference $E[w(s) \mid \theta] - W$ decreases for all low θ, which makes it more attractive for the manager to sell and thus pushes up θ^*. As the loss in profits from a marginal reduction of θ^* is zero at $\theta^* = \theta_{FB}$, it is, however, not optimal for owners to increase W up to the point where the efficient decision rule would be achieved.

Proposition 1. *The restricted problem, where only a single wage scheme $w(s)$ is offered, has the following solution. There is insufficient asset reallocation, $\theta^* < \theta_{FB}$, and the manager receives a strictly positive severance pay, $W > 0$. The uniquely optimal wage scheme consists out of an option on the firm's value in $t = 2$ and a fixed wage equal to the manager's minimum consumption level.*

Proof. See Appendix.

Our results provide a new general rationale for giving CEOs high-powered incentives—though the purpose of high-powered incentives is not to make the manager work harder but to make him less entrenched.[18]

[18] In our setting, all of the manager's future compensation accrues in one period, that is $t = 2$. In practice, the manager's contract may have a duration that is much shorter than his time to retirement. Our results can then be more broadly applied to a firm's general principles of setting management pay. If the manager expects that his future (renewed) contracts with the firm will involve a steep incentive scheme, he is again less eager to "hold

3.3 More Complex Mechanisms: The Owners' General Problem

In our restricted problem, we assumed that owners only offer a single wage scheme $w(s,\theta) = w(s)$. Subject to the manager's truthtelling constraint, there is, however, no reason why owners should be constrained in this way. In what follows, we show that offering a menu with different wage schemes $w(s,\theta)$ is not optimal.

This result is rather intuitive. The optimal single wage scheme $w(s)$ characterized in Lemma 4 shifts as much of the manager's deferred compensation as possible into high s and thus high θ. That is, for a given level of total compensation the manager receives a very high wage for high s and a very low wage for low s. Specifying in addition a less high-powered (and still incentive compatible) wage scheme $w(\theta,s)$ for lower states $\theta^* \leq \theta < \overline{\theta}$ would have the opposite effect of shifting some of the compensation "back" into lower values of s and thus of θ. Consequently, to achieve a given value of θ^* a higher severance pay W would be necessary.[19]

Proposition 2. *Offering a single wage scheme $w(s,\theta) = w(s)$ is uniquely optimal.*

Proof. See Appendix.

Proposition 2 re-emphasizes one of our previous results. The optimal mechanism allows for a very simple implementation. Owners can offer the manager a package consisting out of severance pay and a simple wage scheme $w(s)$ while fully delegating the decision whether to sell the firm.

4 Discussion

4.1 Changes in the Value of Asset Reallocation Opportunities

Our key comparative exercise is now to analyze how the optimal compensation package changes with the profitability of the owners' outside opportunity. Recall that for given W—and, consequently, given θ^*—the optimal $w(s)$ is uniquely determined. However, the the owners' program may generally not be sufficiently concave to yield a unique optimal choice of W and θ^*. For

on" in low states where the firm's future value is likely to be low as well.

[19] Another equally immediate intuition for Proposition 3 is the following. For the decision problem at $t = 1$ only the cutoff type θ^* is important. Using a (non-degenerate) menu of wage contracts $w(s,\theta)$ would thus elicit more information than what is needed. As eliciting more information is costly in a private-information environment, owners optimally extract only the minimum required information.

simplicity, we assume in what follows that the owners' program has a unique solution.[20]

Proposition 3. *Following an increase in P, it is optimal to strictly increase the value of the manager's compensation package by increasing both W and the value of his option grant. As a consequence, θ^* strictly increases.*

Proof. See Appendix.

Following an increase in P, it is less often efficient to continue with the existing strategy and management. (Formally, the efficient decision rule θ_{FB} defined by $E[s \mid \theta_{FB}] = P$ is strictly increasing in P.) As owners are the residual claimants, it becomes likewise optimal to ensure that a higher decision rule θ^* is used, which from our previous arguments requires an increase in both the severance pay and the wage. From Proposition 1, the increase in $w(s)$ is optimally achieved by scaling up the value of the manager's option.

Proposition 3 seems to accord well with some developments that took place over the last two decades: the large-scale reshuffling of capital via mergers and acquisitions as well as internal shake-ups, a corresponding increase in CEO turnover, and fatter compensation packages for CEOs, mostly in the form of more valuable option grants. Incidentally, what drives asset reallocation and management turnover in our model is not so much a deterioration in current performance levels but the expectation of future underperformane relative to alternative business opportunities. The manager participates in the ensuing wealth creation by both a higher severance pay and a higher wage, but this comes at the price of a higher likelihood of being fired (i.e., a higher θ^*).

We are not the first to posit a possible link between the industrial changes and the changes in executive compensation that both took place over the last two decades. Kevin Murphy argues that "traditional executive pay practices established in the 1960s and 1970s were ill-suited for the 1980s and 1990s economies where creating shareholder value involves innovation and entrepreneurism in some sectors, and downsizing, layoffs, obtaining concessions from unions, and in extreme cases even exit in other sectors" (Murphy 1999, p. 22). Holmstrom and Kaplan (2003, p. 13) argue likewise that the shift in compensation practices played a "significant role in the continued restructuring of corporations".[21]

[20] Without this assumption, all results hold in an analogous way for the respective sets of optimal values.

[21] Apart from this broader context, our theory on the interaction of asset reallocation and incentive pay (in

Finally, a few papers have recently tried to explain the shift in CEO pay levels over the last two decades. Hermalin (2003) presents a model where more independent boards monitor managers more intensively and are thus more likely to replace an underperforming manager. CEO pay increases as CEOs, who are kept at their participation constraint, must therefore receive higher salaries. Hermalin's results are, however, silent on *how* CEOs should be compensated for their increasing disutility of running corporations.[22] Murphy and Zabojnik (2003) argue that the last decades have seen a regime shift in the market for CEOs, resulting in a premium for high talent.[23] They show that this gives rise to both a substantial premium for top talent and a shift towards more external hires, which is supported by their data. Again, they are silent on the composition of executive pay.[24]

4.2 Restrictions on the Manager's Compensation Package

Recently, CEOs' big pay packages have come under increasing public scrutiny. Under public pressure, institutional investors have turned against generous pay packages and, in particular, against granting large severance pay deals.[25] According to our model, a lower value of W is

particular, stock options) is consistent with a number of empirical findings. Mehran, Nogler, and Schwartz (1997) find that CEO stock ownership and stock options have a positive effect on the likelihood of voluntary liquidation. Dial and Murphy (1995) document the case of General Dynamic's partial liquidation, arguing that executives' incentive plans were large enough to motivate them to sell off assets and thereby sacrifice even their own positions.

[22] One implication of Hermalin (2003) is that boards become more demanding, i.e., they become more willing to fire CEOs after receiving "bad signals". This seems not to conform well with evidence in Mikkelson and Partch (1997), Huson et al. (2001), and Murphy and Zabojnik (2003), who find that CEOs' likelihood to depart following poor performance has either not changed or even decreased in the 90s. Also, the link between more diligent boards and the *relevance* of incentive pay remains to be explored.

[23] Himmelberg and Hubbard (2000) also link higher management compensation to the rise in the stock market, claiming that positive stock market shocks were associated with higher managerial productivity.

[24] Murphy (1999) and Bizjak, Lemmon, and Naveen (2003) argue that some of the pay increase may have occurred "mechanically" as escalating stock markets pushed up the value of grants that were awarded on a "fixed share" basis, which had an increasing knock-on effect as benchmarking became more widely used.

[25] In the U.K., since 2002 public companies are legally required to pass a resolution on directors' pay in their annual meetings. Though a rejection by shareholders as *no* legal consequences, this provision has created much recent publicity for shareholders' rebellion against "fat-cat pay", e.g., in the case of the advertising company WPP, the retailing chain Sainsbury's, and—most famously—the rejection of the £20 million severance pay for the head of GlaxoSmithKline, Britain's biggest drug manufacturer.

indeed in the owners' best interests if opportunities to reallocate assets at a large scale become less valuable. Otherwise, however, any binding restriction on the manager's rent and thus his severance pay W must ultimately hurt owners as it leads to a deviation from the optimal contract. While such a cap indeed reduces the manager's rent, it also reduces efficiency and owners' profits. The following result follows immediately from Lemma 4 and Proposition 1.

Proposition 4. *If there is a binding cap on the value of the manager's total compensation package, the manager and owners are both worse off and assets are less often reallocated as θ^* is strictly lower.*

Alternatively, a firm may face constraints on *how* to compensate the CEO. In fact, the view to actively *discourage* the use of options for executive compensation has recently gained ground among both policymakers and academics. For instance, Paul Volcker, the current chairman of the International Accounting Standards Committee and a former chairman of the board of the Federal Reserve System, explicitly advocates to discourage public companies from using options for compensation (The Conference Board (2002), p. 12). Becht, Bolton, and Roell (2002) claim that "it is widely recognized that these options are at best an inefficient financial incentive and at worst create new incentive or conflict-of-interest problems of their own."

According to our theory, however, options for executives perform an important role in reducing management's resistance to fundamental changes. As noted in the Introduction, this may comprise the decisions to liquidate the firm or to sell its assets to a new owners. Likewise, the fundamental change may be achieved by an internal reorganization under a new leadership, which chooses different business priorities. Any compensation package that does not leave the manager with more rents but also excludes options must necessarily stifle the amount of change, i.e., more formally lead to a reduction of θ^*.[26]

Overall, our results suggest that imposing restrictions to cure the witnessed "excesses" in executive pay may backfire and create more managerial entrenchment, lower profits, and less change. Likewise, our results suggest that the changes in U.S. executive compensation may have been necessary to better exploit the opportunities of the "modern industrial revolution". This conclusion is in line with the arguments of Holmstrom and Kaplan (2001, 2003), who point out that if the changes in executive pay were the outcome of a defunct corporate governance system,

[26] For instance, the German Corporate Governance Code (2002) explicitly mentions the use of a cap on the total value of the variable components.

it would be surprising that at the same time the U.S. stock markets outperformed those of many other OECD countries.

5 Conclusion

This paper investigates how managers should optimally be compensated so as to reduce their bias against fundamental changes that may cost their own jobs, e.g., the sale or liquidation of the firm or a strategic reorientation of the firm's business. We find that a combination of options plus fixed pay together with severance pay is uniquely optimal. Severance pay naturally reduces management's resistance to changes that may involve the loss of their own jobs. Compensating management with options in turn reduces their incentives to hold on to their jobs in precisely those states where a large-scale change would be the more profitable alternative.

In our model, the primary function of incentive–or, more precisely, option—pay is thus to induce more efficient decision-making. We thereby follow Murphy (1999), who points out that "the fundamental shareholder-manager agency problem is not getting the CEO to work harder, but rather getting him to choose actions that increase rather than decrease shareholder value." We find that as the owners' alternative opportunities become more profitable, it is optimal to increase total compensation by scaling up both their severance pay and the value of their option grant. This result may help to understand the profound changes in executive compensation over the last two decades: the increase in overall pay and the growing importance of option pay. Our analysis links these changes in executive pay to the fundamental economic changes that have taken place over this period (the "modern industrial revolution"), which created vast opportunities for reshuffling capital out of old and into new industries. As our analysis also shows, economies with (formal or informal) restrictions on executive pay, e.g., on its overall value or the use of options, should be less able to exploit new opportunities and should thus experience less (or slower) industrial change.[27]

[27] For instance, in Japan stock options for CEOs were not legal before 1997. In Germany, the intense debate of the German Corporate Governance Code (2002) highlighted the deep public resentment against large payouts to top management, which may severely constrain firms' compensation policies.

6 Appendix: Omitted Proofs

Proof of Lemma 4. We argue to a contradiction and assume that, for given θ^*, some $\widetilde{w}(s)$ with $\widetilde{w}(s) \neq C + \max\{0, \delta(s - \widehat{s})\}$ was optimal. We denote the corresponding severance pay by $\widetilde{W}$. We show that there exists some other $w(s)$ such that (i) the incentive constraint (8) remains binding and that (ii) θ^* is still achieved but with a lower severance pay W, i.e., with a slight abuse of notation that $\theta^*(w, W) = \theta^*(\widetilde{w}, \widetilde{W}) = \theta^*$ and $W < \widetilde{W}$, which contradicts optimality.

We proceed in two steps. We first choose $\overline{W} = \widetilde{W}$ and $\overline{w}(s) = C + \max\{0, \delta(s - \widehat{s}')\}$ such that $\theta^*(\overline{w}, \overline{W}) = \theta^*$, i.e., with $d(s) = \widetilde{w}(s) - \overline{w}(s)$ we have that

$$\int_S d(s) g_{\theta^*}(s) ds = 0. \tag{10}$$

As $\widetilde{w}(s)$ and $s - \widetilde{w}(s)$ are both nondecreasing, there exists a value $\widetilde{s} \in (\underline{s}, \overline{s})$ such that $d(s) \geq 0$ for all $s < \widetilde{s}$ and $d(s) \leq 0$ for all $s > \widetilde{s}$, where both inequalities are strict over sets of positive measure. Take now any $\widehat{\theta} > \theta^*$. By MLRP of $G_\theta(s)$ and (10), it then holds that

$$\begin{aligned} & \int_S d(s) g_{\widehat{\theta}}(s) ds \\ = & \int_{\underline{s}}^{\widetilde{s}} d(s) g_{\theta^*}(s) \frac{g_{\widehat{\theta}}(s)}{g_{\theta^*}(s)} ds + \int_{\widetilde{s}}^{\overline{s}} d(s) g_{\theta^*}(s) \frac{g_{\widehat{\theta}}(s)}{g_{\theta^*}(s)} ds \\ < & \frac{g_{\widehat{\theta}}(\widetilde{s})}{g_{\theta^*}(\widetilde{s})} \int_S d(s) g_{\theta^*}(s) ds = 0, \end{aligned} \tag{11}$$

which by (8) implies that the incentive constraint is slack under $(\overline{w}, \overline{W})$. In a second step, we can now construct the asserted contract with $w(s) = C + \max\{0, s - \widehat{s}\}$ and $W < \overline{W} = \widetilde{W}$. For this we (continually) increase $\widehat{s}'$ (the strike price) and decrease $\overline{W}$, while still satisfying $\theta^*(\overline{w}, \overline{W}) = \theta^*$, until the incentive constraint becomes binding. That this is possible follows as, while we keep $E[\overline{w}(s) \mid \theta^*] = \overline{W}$ satisfied, the difference $E[\overline{w}(s) \mid \theta] - \overline{W}$ continuously decreases for all $\theta > \theta^*$. To see this, note that after partial integration we have

$$\frac{d}{d\widehat{s}'} E[\overline{w}(s) \mid \theta] = -[1 - G_\theta(\widehat{s}')], \tag{12}$$

which from MLRP (and thus First-Order Stochastic Dominance) of $G_\theta(s)$ is strictly decreasing in θ. **Q.E.D.**

Proof of Proposition 1. By Lemmas 1-4, it remains to prove that $\theta^* < \theta_{FB}$. Using partial differentiation, (6) transforms to

$$C + (\overline{s} - \widehat{s}) - \int_{\widehat{s}}^{\overline{s}} G_{\theta^*}(s) ds = W \tag{13}$$

and (8) transforms to

$$\int_{\theta^*}^{\overline{\theta}} \left[C + (\overline{s} - \widehat{s}) - \int_{\widehat{s}}^{\overline{s}} G_\theta(s) ds - W \right] f(\theta) d\theta = c. \tag{14}$$

From (13) and (14) we then have by total differentiation (and the assumed differentiability of $G_\theta(s)$) that

$$\frac{d\theta^*}{dW} = \frac{\int_{\theta^*}^{\overline{\theta}} \left[G_\theta(\widehat{s}) - G_{\theta^*}(\widehat{s}) \right] f(\theta) d\theta}{\left[\int_{\theta^*}^{\overline{\theta}} \left[1 - G_\theta(\widehat{s}) \right] f(\theta) d\theta \right] \left[\int_{\widehat{s}}^{\overline{s}} \frac{G_\theta(s)}{d\theta}_{\theta=\theta^*} ds \right]} > 0. \tag{15}$$

Using (15), we obtain for the owner's program the first-order condition w.r.t. W

$$\sigma_{\theta^*} - P = \frac{F(\theta^*)}{-(d\theta^*/dW)}. \tag{16}$$

As we assumed that an interior solution $\underline{\theta} < \theta^* < \overline{\theta}$ is optimal for owners, (16) implies for an optimum that $\sigma_{\theta^*} < P$ and thus $\theta^* < \theta_{FB}$. **Q.E.D.**

Proof of Proposition 2. Recall first from the proof of Proposition 1 that under the optimal contract there is a one-to-one mapping between θ^* and W with $d\theta^*/dW > 0$. The result for W and θ^* follows then immediately from implicit differentiation of the first-order condition (16). Finally, to keep the incentive constraint satisfied, we have from (14) that an increase in W must be matched by a decrease in $\widehat{s}$. **Q.E.D.**

Proof of Proposition 3. Note that we can again restrict consideration to wage schemes $w(s, \theta)$ that are strictly increasing at some s. This follows immediately from the observation in Lemma 1 that a flat wage does not relax the incentive constraint as it requires that $w = W$. Given that all $w(s, \theta)$ are thus strictly increasing somewhere and that $G_\theta(s)$ satisfies MLRP, the truthtelling constraint implies again that $\Theta_+ = [\theta^*, \overline{\theta}]$ with[28]

$$E[w(s, \theta^*) \mid \theta^*] = W. \tag{17}$$

The following auxiliary result follows now immediately from the proof of Lemma 4.

Claim 1. *Take two different feasible contracts $\widetilde{w}(s)$ and $\widehat{w}(s) = C + \max\{0, s - \widehat{s}\}$. Then if*

$$E[\widehat{w}(s, \theta') \mid \theta'] \geq E[\widetilde{w}(s, \theta') \mid \theta'] \tag{18}$$

[28] Formally, we use that the maximum of continuous and strictly increasing functions is again continuous and strictly increasing.

holds for some $\theta' < \overline{\theta}$, (18) holds strictly for all $\theta > \theta'$.

To prove Proposition 3, we distinguish between two cases. If $w(s,\theta^*) = C + \max\{0, \delta(s-\widehat{s})\}$, Claim 1 and truthtelling imply that $w(s,\theta) = C + \max\{0, \delta(s-\widehat{s})\}$ holds for all θ, i.e., the menu is degenerate as only one compensation scheme is adopted. Suppose next that $w(s,\theta^*) \neq C + \max\{0, \delta(s-\widehat{s})\}$. We can now show by an analogous argument to that in Lemma 4 that this can not be optimal. As in the proof of Lemma 4, we first construct a single contract $w(s) = C + \max\{0, \delta(s-\widehat{s})\}$ that leads to the same decision rule θ^*. The key argument is again that with this offer the incentive constraint is relaxed. This follows as for all $\theta > \theta^*$ we have that

$$E[w(s) \mid \theta] > E[w(s,\theta) \mid \theta],$$

which in turn follows immediately from incentive compatibility of the original offer and Claim 1. As in Lemma 4, we can then adjust the new simple wage scheme $w(s)$ so as to implement θ^* with a lower severance pay. **Q.E.D.**

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