CEO Compensation, Change, and Corporate Strategy

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ABSTRACT

CEO compensation can influence the kinds of strategies that firms adopt. We argue that performance-related compensation creates an incentive to look for overly ambitious, hard to implement strategies. At a cost, shareholders can curb this tendency by precommitting to a regime of CEO overcompensation in highly changeable environments. Alternatively shareholders can commit to low CEO pay, although this requires a commitment mechanism (either by the board of the individual company, or by the society as a whole) to counter the incentive to renegotiate upwards. We study the conditions under which the different policies for CEO compensation are preferred by shareholders.

We have created a cult of leadership that far exceeds anything that existed decades ago... What we are getting now, very dangerously, is what I call a dramatic style of managing; the great merger, the great downsizing, the massive brilliant new strategy... So we get all these massive mergers, fire, brimstone and drama, because you can't say to the stock analysts, "we're getting our logistics all straightened out, we're going to be much more efficient at throughput to the customer." They start to yawn. (Mintzberg (2000, p. 31))

The problems resulting from separation of ownership and control have long been recognized in the corporate governance and corporate finance literature (See, e.g., Berle and Means (1932), Jensen (1986), Hart (1995), Shleifer and Vishny (1997)). Mintzberg's analysis of the cult of leadership has three elements: (i) companies need to change and adapt; (ii) the CEO, rather than the shareholders, has power to decide on the direction of change (the *strategy*); and, (iii) the CEO may not select the optimal kind of change (for shareholder value)—it may be overly dramatic. In this paper, we study this idea from the

perspective of the corporate governance literature, that is, using agency theory. Note that much of this literature has used an incomplete contracting approach (Hart (1995)), and each of the three elements in Mintzberg's argument suggests contractual incompleteness. This is the approach we take here.

Standard agency theory takes as given the existence of an incentive problem. The principal and agent agree on a (constrained) optimal contract, and then the agent goes to work on the problem. One feature of CEO compensation that is clearly different from this standard agency model is the fact that the contract is adjusted over time to reflect the evolution of the firm's performance and its strategic direction. There is an annual pay-setting round at which options and incentive plans are renegotiated. Also, since he or she can influence the firm's strategy, the CEO may be able to influence the compensation contract: A dramatic merger, or restructuring of the whole business, can lead to larger options grants.

There are many examples in recent corporate history in which radical corporate change went hand-in-hand with high executive compensation and options grants: Coca-Cola under Roberto Goizueta, the Daimler–Chrysler merger, GE under Jack Welch, Chris Gent and the Vodafone-Mannesmann takeover, the Glaxo Wellcome–SmithKline Beecham merger. Some of these dramatic changes were successful, others were failures.[1] Our paper is not about disastrous dramatic change. It is about change that is expected positive net present value (NPV) at the outset, given the available information, that may end up being either successful or unsuccessful, but that is *overly dramatic* in the sense that less radical change would have resulted in higher NPV. We argue that the way executive compensation responds to changes in strategy can lead to management choosing change that is more radical than the shareholders would optimally prefer. For instance, the CEO of a regional electricity utility may find it personally more profitable to create a global web-based energy market-maker. We then look at ways in which the incentive contract can be modified at the outset to anticipate this problem.

This analysis is consistent with (but not identical to) two themes that run through much of the corporate finance literature, namely, free cash flow theory and nonvalue-creating mergers. First, there is free cash flow theory. Jensen (1986, 2000), building on earlier analyses of managerial empire-building (Baumol (1959), Marris (1967), and Williamson (1964)), has argued that managers of public corporations have a systematic tendency to overinvest.[2] Overinvestment of free cash flow can be viewed as similar to overly dramatic change. For example, cash-generating low-growth businesses may tempt their managers to seek growth through excessive diversification. Lang and Litzenberger (1989), Lang,

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[1] Some of the failures can only be criticized with the benefit of hindsight, while others seemed doomed from the outset.

[2] He has even argued that this is so costly that the public corporation is not an efficient institutional vehicle for business ownership, and should be replaced by other institutions (Jensen (1989)). However, Jensen does not share the perspective offered in this paper that strong incentives may actually exacerbate managerial conflicts of interest.

Stulz, and Walking (1991), Mann and Sicherman (1991), Blanchard, Lopez-de-Silanes, and Shleifer (1994), Kaplan and Zingales (1997), and Lamont (1997) provide empirical evidence supporting this theory.

Second, there is evidence that many mergers add little or no value to the acquirer (Asquith, Bruner, and Mullins (1983), Jarrell, Brickley, and Netter (1988), Bradley, Desai, and Kim (1988), Jarrell and Poulsen (1989), and Bruner (2002)).[3] Mergers are a clear example of dramatic change, and hence, this evidence can help explain why managers may undertake dramatic acquisitions even when this is not shareholder-value maximizing.

Change is obviously valuable and necessary, and of course we do not argue that change is intrinsically bad. What we do argue in this paper is that firms may sometimes change in a suboptimal way. This may be particularly relevant given that in recent years there has been a high rate of corporate change. The 1990s were a decade of mega-mergers. U.S. merger and acquisition activity from 1993 to 1999 amounted to an annual average of 8.4% of GDP, compared with less than 4% in the 1980s and less than 2% in the 1970s (Weston, Siu, and Johnson (2001), Table 7.4). Moreover, in previous decades merger targets were typically about 10% of the size of the acquirers, but in the 1990s it became common for companies to acquire targets almost as large as, or sometimes even larger than, themselves (AOL-Time Warner and Vodafone-Mannesmann, for example).

The basic outline of our model is as follows. We assume shareholders are able to set compensation optimally (subject to incentive compatibility constraints), but that top management has the advantage of formulating strategy. After the CEO has chosen a strategy, incentives are set or adjusted before the CEO proceeds to implementation of the chosen strategy. The CEO's ability to formulate strategy is part of his job, so this is a natural assumption. We use a setting with incomplete contractibility[4] and limited liability[5] for the manager, which leads to an option-like contract (reward for success, no penalty for failure) conditioned on firm value.

We assume that change requires substantial effort from the CEO at the implementation stage, while business as usual requires much less. Hence, the reward for success must induce the CEO to put in enough effort to implement change, not only in comparison to the alternative of no effort, but also in comparison to the alternative task of maintaining the status quo. Since implementation of

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[3] There is some overlap between free cash flow theory and research on nonvalue-creating mergers, since free cash flow may be spent on acquisitions. However, free cash flow may also be spent on other projects, and many acquisitions are paid for with external finance (new debt or new stock). Note also that our model can explain mergers that add little value to the acquirer, but cannot explain mergers that are value destroying.

[4] A detailed motivation of the form of contractual incompleteness, and discussion of this hypothesis, is given in the appendix.

[5] This feature of CEO compensation is sometimes criticized, but nevertheless it seems to be almost universal (unlike small private businesses, where the entrepreneur often pledges collateral to a bank or venture capitalist). In Tirole's (2001) recent graduate textbook on corporate finance, all of the models make the same assumption as we do. Studying the economic rationale for this feature, if there is one, would be interesting but is not the subject of this paper.

a given strategy is noncontractible, we show that the latter constraint is the binding one. Also, the more personally demanding the alternatives he finds to the status quo, the higher is his surplus.[6] By choosing a task whose success is highly dependent on his own performance, the CEO is able to extract higher surplus from his shareholders. We conclude that high-powered incentives can encourage overly dramatic strategies.[7]

Anticipating this problem, what could shareholders do to mitigate it? If they are concerned that the CEO's incentives are not well aligned with their own, they could simply give him enough options or equity at the outset and the conflicts would disappear. In other words, if they are worried that corporate strategy may be distorted by the CEO so as to extract larger incentive packages of equity or options, they could simply hand over the large package at the outset. We show that in very unstable environments, characterized by a high likelihood of change (particularly dramatic change), ex ante contracting might be optimal for shareholders. Thus, high compensation can reflect strategic discretion, rather than being proportionate to the CEO's effort cost of implementation.

While this approach ("ex ante contracting") works, there is a tradeoff to be made: It is expensive. Specifically, the drawback of this type of contract is that the shareholders commit in advance to high compensation packages as a deterrent to overly dramatic change, even though, ex post: dramatic change might turn out not to be an option anyway. Assume that the firm's strategic environment is not completely predictable in advance, and that the CEO has the advantage of being better informed about it than the shareholders. Then there is a range of possible strategic choices, not all of which are always available. In some states of the world, dramatic change is the only positive NPV alternative to the status quo; in other states, more moderate change is also available (and is higher NPV than dramatic change), while in yet other states dramatic change is not an option. In the last case, ex ante contracting means that the CEO ends up being unnecessarily highly paid to implement a simple strategy. Thus, in environments in which dramatic change is less likely to be an option, shareholders may prefer a wait-and-see approach to contracting, setting the compensation package after the strategy is chosen and accepting that this approach might cause distortion in the strategy-selection process.

Another way for shareholders to discourage excessively dramatic strategies would be for them to commit in advance not to pay high salaries. It might be difficult for shareholders to credibly enter into a commitment that ex post they may want to renegotiate, but perhaps social norms could be the mechanism that limits CEO pay. We extend the analysis to investigate this case. Such

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[6] Core and Guay (2002) present empirical evidence that more unstable environments tend to be positively related to CEO pay–performance sensitivity.

[7] High-powered compensation can also cause two other problems: (i) straight cheating by managers; and, (ii) managerial rent-seeking through control of the contracting process. CEOs may use false accounting to overstate profits and inflate the stock price, and instead of representing shareholders' interests, boards may cooperate with management in agreeing to excessive compensation. However, those are not the problems we study here.

commitment works in dissuading the CEO from unnecessary dramatic change, but again there is a tradeoff as this policy is equally effective in dissuading the CEO from dramatic change in states in which it is desirable.

How can the conclusions of our model be used to throw light on the evolution of executive pay in the past 10–15 years? We believe that during this period, shareholders have become much more aware of the need for large public firms to change. This is partly due to the revolutionary technological changes that have taken place. It may also be that shareholders simply became more aware of this general issue, following a period in the late 1980s during which many firms that had become insufficiently focused on value creation were restructured by external means (leveraged buyouts and other hostile takeovers). In terms of our model, we could hypothesize that before this period, there were informal political and social conventions that effectively limited CEO pay, and that these limits became suboptimal because of changes in the parameters of the model, breaking down as the pressure for change suggested higher and higher CEO pay. In other words, there was a switch from upper limits on pay, to ex ante contracting with large incentive pay packages. Another possible explanation for the changes in compensation practice is that the "difficulty level" of likely strategies increased over time, which is also consistent with our analysis.

The paper is structured as follows. Section I presents the model and the main results of the paper. In Section II, we consider extensions in terms of the contracting mechanism, allowing the firm to set a contract ex ante, or to precommit to a ceiling in compensation. Section III discusses related empirical and theoretical literature. Section IV concludes.

I. Modeling Strategy Formulation and Implementation

We assume the firm is run by a risk-neutral manager with no personal financial resources. There are two main steps: The manager formulates a strategy, and then implements it. (As we will detail in Section A, there is one opportunity for contracting between these two steps, and there is another opportunity right at the outset, before the first step.)

Strategy formulation: We assume that the outcome of the strategy formulation process—that is, the strategy that is proposed by the manager—is influenced both by the manager's choice and by random factors. The way we model strategy formulation is to suppose the CEO is presented with a random menu of strategies, from which he can pick one only, which he then presents to the shareholders in addition to the status quo option of no change.

The reason for this assumption is that, because this paper is about incentives for strategy formulation, we clearly need to assume that the manager's choice has a role to play. However, we also need to assume some randomness. If the outcome depended only on the manager's choice and there were no uncertainty, the shareholders would know as much about the firm's strategic environment as the manager. In that case, it would be unrealistic to suppose the choice of

strategy would be delegated to the manager.[8] It is plausible to assume that the firm's strategic environment is better known to the CEO than to the shareholders. Also, developing a strategy takes time and requires a large amount of attention from the CEO; hence he cannot realistically formulate and present to the shareholders worked-out plans for implementing all the strategies on the initial menu—he has to choose.[9]

To be specific, we assume that with probability p, the menu of strategies observed by the manager contains some alternative to the status quo strategy B, "business-as-usual." With probability $(1 - p)$, there is no alternative; we call this scenario B. If there *is* an alternative, then the menu can contain a single alternative to B, or two alternatives. This last case presents the manager with a choice between two strategies as an alternative to B.[10] The alternative strategy may be for moderate change, M, or dramatic change, D. Conditional on change of some kind being possible, there is a probability q_M that moderate change M will be the only alternative on the menu (we call this scenario BM), probability q_D that dramatic change D will be the only alternative (scenario BD), and probability $1 - q_M - q_D$ that both M and D will be available (scenario BMD).

When the manager picks one of two alternatives to formulate and present to shareholders as his strategy, the discarded alternative ceases to be available. Of course, when the manager presents his strategy, the shareholders do not know whether it was the only option from the outset, or whether there were two alternatives. For example, if the manager presents a plan for dramatic change, the shareholders cannot tell whether this was the only option (scenario BD) or whether he earlier discarded the option of moderate change (scenario BMD). If his incentives cause him to prefer dramatic change, the shareholders can reason that either scenario may have occurred. They can use Bayes' Rule to infer the likelihood of each of these two possibilities, and this will be an input into their choice of optimal contract design—for instance if they themselves would prefer moderate change.

Strategy implementation: We describe the strategies in terms of parameters, and impose some conditions on these parameters. Strategy i (for $i = B, M$, or D) requires effort e_i from the CEO and has a probability π_i of success, in which case the firm is worth V. Otherwise (no effort, or sufficient effort but bad luck), the firm is worth nothing.

Strategy M, moderate change, involves more effort than carrying out business as usual B and also has a higher success rate. Likewise, strategy D, dramatic change, represents a more radical restructuring than M and requires higher

[8] And, in any case, the tradeoffs would become trivial. Anytime the shareholders wished to stop the manager from choosing dramatic change, the "ceiling in compensation" that we describe below would be a costless way of forcing him to obey their preference.

[9] On the other hand, there is no need to formulate a plan merely to stick with the status quo, so this option always remains available.

[10] If there is no alternative to B, the manager cannot report any alternative to the shareholders, while if there is a single alternative, the manager presents it.

managerial effort. We also assume it has a higher success rate than M. So, $e_B < e_M < e_D$ and $\pi_B < \pi_M < \pi_D$. We assume there are diminishing returns to effort in implementing change

$$\pi_M \frac{e_B}{e_M} < \pi_B \tag{1}$$

and

$$\pi_B + (\pi_D - \pi_B)\frac{e_M - e_B}{e_D - e_B} < \pi_M. \tag{2}$$

The relation between effort and chance of success is graphed in Figure 1. These conditions, intuitively, say that the graph looks like a concave function.[11] The assumption of diminishing returns is key to our analysis. As we shall see, the idea that really dramatic change is very costly to implement is important in deriving our results. Further motivation for this assumption is given in Appendix A.

Parameter restrictions: We impose further assumptions on the parameters. First, we assume that

$$V \geq \frac{e_B}{\pi_B}. \tag{3}$$

This simply means that shareholders are willing to compensate the CEO for his effort in implementing strategy B; that is, the project is positive NPV in a first–best sense. For the other strategies, we impose

$$\left(V - \frac{e_i - e_B}{\pi_i - \pi_B}\right)\pi_i - \left(V - \frac{e_B}{\pi_B}\right)\pi_B \geq 0, \tag{4}$$

for $i = M$ or D. Condition (4) states that the shareholders will be willing to pay for the CEO to carry out the strategy for change (M or D) if it is presented as an alternative to the status quo B. This means that these strategies are positive NPV in a second-best sense that takes into account a further incentive compatibility condition, in addition to compensating the CEO for effort (as will become clear below). This condition is stronger than simply assuming that M and D are positive NPV in a first–best sense; that is,

$$\left(V - \frac{e_i}{\pi_i}\right)\pi_i \geq \left(V - \frac{e_B}{\pi_B}\right)\pi_B. \tag{5}$$

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[11] Formally, one cannot say that there is a concave function linking effort and success rate because the function is not defined on a compact set. It is only defined at effort levels $0, e_B, e_M$, and e_D. If we "fill in" with straight lines between the four points $(0, 0), (e_B, \pi_B), (e_M, \pi_M)$, and (e_D, π_D), then the resulting function is concave.
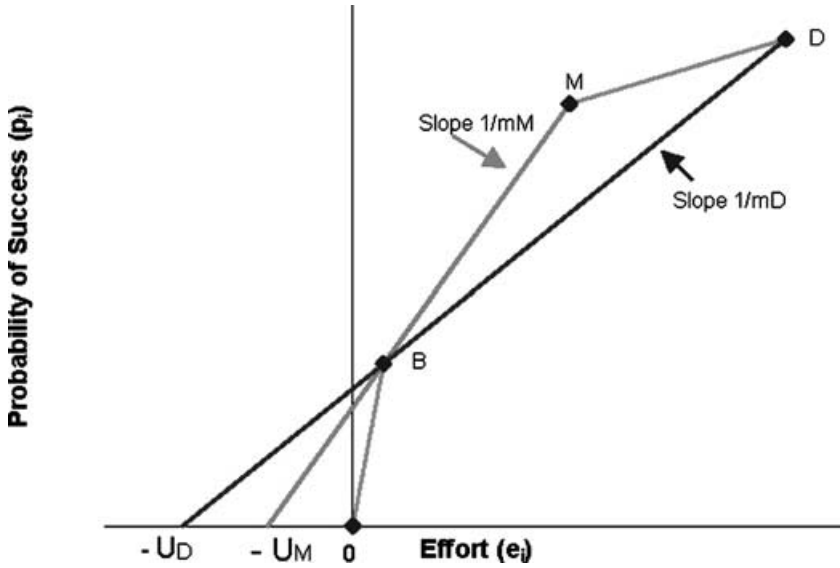
Figure 1. CEO's preferences in terms of strategies.

In line with our discussion in the introduction, we are particularly interested in the case in which M is first–best, that is, the extra chance of success of strategy D (compared to M) is outweighed by the effort cost:

$$\left(V - \frac{e_M}{\pi_M}\right)\pi_M \geq \left(V - \frac{e_D}{\pi_D}\right)\pi_D. \tag{6}$$

However, this condition is not required as an assumption for the analysis (see the discussion of Proposition 2 in Section I.B).

A. Contracting between the Shareholders and the Manager

There are three main elements to contracting in our model: The manager's limited liability, the assumptions on contractibility, and the timing.

Since the manager has no financial resources, the contract he agrees with the shareholders can stipulate nonnegative payments only. We assume that strategies are observable, but not verifiable. Hence, a contract can stipulate a payment that is conditional on firm value, but not on strategy. We consider contracts that take the form of a positive payment if the firm is worth V, and no payment if the firm is worth nothing.

Two key implications of the contractibility assumption are that (i): it is not possible to make payments conditional on the strategic plans that the CEO proposes to the shareholders and, (ii); the CEO can agree to implement change and later decide that he prefers to stick to the (easier) status quo. In Appendix A, we give a detailed discussion and motivation of the noncontractibility assumption.

Potentially, there are two times when contractual arrangements could be made or renegotiated: After the manager has formulated a strategy but before he has implemented it, and at the initial stage before he has had time to formulate a strategy. We consider three types of contracts, and study conditions for each to be optimal. The first type is what we call "ex post contracting." In this case, the contract is not set until after the CEO has formulated the strategy. This allows the contractual terms to be set in response to the strategy that the manager has formulated. The second type is what we call "ex ante contracting," where the contract is set at the beginning, but can then be renegotiated afterwards by mutual agreement, in response to the strategy formulated by the manager. We then extend the analysis to consider a third type of contracting in which, as part of an ex ante contract, shareholders commit to rule out renegotiation. Both in the initial negotiation and in the event of renegotiation, we maximize the principal's payoff subject to meeting the agent's reservation utility level.[12]

B. Setting CEO Compensation Once Strategy Is Decided: Ex post Contracting

To start, suppose that CEO compensation is not fixed initially. Instead, the shareholders wait until the CEO has presented his strategy, then they set the compensation package. In the simplest case (occurring with probability $1 - p$), there is no option for change and the manager's task is simply to implement strategy B. Let m_B be the contractual payment in the event that the firm is worth V. Incentive compatibility requires

$$m_B \pi_B - e_B \geq 0, \tag{7}$$

and the solution is[13]

$$m_B = \frac{e_B}{\pi_B}. \tag{8}$$

The CEO obtains his reservation utility level (zero) in this case.

Alternatively, the manager may report that there is an opportunity for change (either M or D). The resulting payment, conditional on the firm being worth V, is denoted m_i ($i = M$ or D). If the shareholders agree to implement i, then there are two incentive compatibility conditions. The first requires expected compensation to outweigh the effort cost,

$$m_i \pi_i - e_i \geq 0, \tag{9}$$

and the second requires that the manager really has an incentive to choose i over B. Since the choice of strategy is not contractible, if the payment is inadequate, the CEO may pretend to implement i but actually stick to B. The condition is

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$$m_i \pi_i - e_i \geq m_i \pi_B - e_B. \tag{10}$$

It follows immediately from assumption (1) and (2) that (10) is the binding constraint; thus the optimal contract overcompensates the manager relative to his reservation wage (zero). The solution is[14]

$$m_i = \frac{e_i - e_B}{\pi_i - \pi_B}. \tag{11}$$

We denote the CEO's expected payoff from strategy i as U_i,

$$U_i = m_i \pi_i - e_i \tag{12}$$

$$= \pi_B \left(\frac{e_i - e_B}{\pi_i - \pi_B} \right) - e_B, \tag{13}$$

where the second equation follows by setting equality in (10) and substituting (11). We can use this derivation to see the characteristics a CEO likes in a strategy.

Perversely, the manager prefers strategies with a lower chance of success and a higher effort level:

PROPOSITION 1: *So long as the parameters of the model satisfy condition (4), the CEO's preferences for strategies are increasing in effort e_i and decreasing in the chance of success π_i.*

Proof: Immediate by inspection of (13). Q.E.D

Furthermore, we can conclude that if the CEO has a choice, he prefers to formulate strategy D over $M : U_D > U_M$, since diminishing returns (2) implies $\frac{e_D - e_B}{\pi_D - \pi_B} > \frac{e_M - e_B}{\pi_M - \pi_B}$. This result can be visualized from Figure 1—given diminishing returns to effort, the CEO will always prefer to formulate the more demanding, difficult-to-implement strategy.

Turning to the shareholders, they prefer both M and D to B, even taking into account the agency costs of implementing them. Both types of change have higher NPVs than B (which is itself positive NPV), by assumption (4). However, shareholders may not agree with the CEO's unambiguous preference for D over M. It could be that in scenario BMD, when the manager initially chooses between M and D, he picks D while the shareholders would prefer M.

The following result characterizes the equilibrium of the model and the conditions under which there is a conflict of interest between the shareholders and the CEO. In such a case the CEO chooses to formulate the more complex strategy D, even if shareholders would have benefitted more from strategy M. First define

$$\widehat{V} \equiv \left(\frac{e_D - e_B}{\pi_D - \pi_B} - \frac{e_M - e_B}{\pi_M - \pi_B} \right) \frac{\pi_B}{\pi_D - \pi_M} + \left(\frac{e_D - e_M}{\pi_D - \pi_M} \right) \tag{14}$$

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[14] We have assumed in (4) that shareholders are willing to pay that much. In other words, i has a higher (positive) NPV than B, even allowing for the extra agency costs of implementing it as an alternative to B.

$$= \frac{(m_D - m_M)\pi_B + (e_D - e_M)}{\pi_D - \pi_M}. \tag{15}$$

We can now show:

PROPOSITION 2: *Suppose that the parameters of the model satisfy conditions (2), (3), and (4) and the shareholders use ex post contracting.*

  (i) The CEO presents the hardest strategy i ($i = B, M, D$) possible, and gets compensation m_i.
  (ii) Shareholders agree with this choice except for scenario BMD with $V < \hat{V}$. In that case, they prefer moderate change M while the CEO picks D.

Proof: Part (i): This part of the proposition is immediate because the strategy choices are trivial, and the compensation contracts have been derived above.

Part (ii): Conditions (2), (3), and (4) ensure that the CEO prefers to formulate strategy $D : U_D > U_M$, as in Proposition 1.

Turning to the shareholders' preferences, given a straight choice between M and D, they would prefer M so long as

$$(V - m_M)\pi_M > (V - m_D)\pi_D; \tag{16}$$

that is,

$$V(\pi_D - \pi_M) < (e_D - e_M) + (U_D - U_M), \tag{17}$$

which, with some algebra, corresponds to $V < \hat{V}$.   Q.E.D.

Condition (17) has a natural interpretation: The left-hand side is the extra value created by strategy D; the first term on the right is the extra cost (in terms of managerial effort) of implementing D, and the second term represents the additional rents earned by the manager from ex post contracting to implement D. We conclude that ex post contracting creates a further layer of agency conflict in addition to the standard agency problem that the agent is reluctant to exert effort. The CEO's strategy choice is distorted because he has an incentive to seek hard strategies with an unfavorable effort/success ratio, which drive up the required compensation. He will tend to promote dramatic change D, even if it is not in the shareholders' best interests.

Our main concern in this paper, in line with our discussion in the introduction, is the case in which D is "overly dramatic" in the sense that M is first–best (condition (6)). Because $V < \hat{V}$ is implied by (6), in this case, there will be a conflict of interest between shareholders and the manager using ex post contracting. Define V' to be the firm value such that (6) holds with equality; one can show that $V' < \hat{V}$. Our main interest is the case $V < V'$. If V becomes large enough, there is a range ($V' \le V < \hat{V}$) in which there is still a conflict of interest between shareholders and manager, but D is actually first–best. The divergence between shareholders' interests and the first–best arises because

they have to pay the manager more than the disutility of effort. If V is larger still ($\hat{V} \leq V$), then both parties prefer D.

II. Setting Compensation to Influence Strategy Formulation

We now focus attention on the interesting case in which the shareholders and the CEO disagree over strategies (i.e., $V < \hat{V}$ as defined in the previous proposition). Anticipating the conflict of interest with ex post contracting, shareholders may seek to improve the alignment between their interests and the CEO's by designing a better compensation package at an earlier stage. In this section, we explore two ways for shareholders to correct the CEO's incentives for strategy choice, and we discuss the conditions under which each is optimal.

A. Ex Ante Contracting

Clearly, one way of ensuring better alignment of interests is just to give the CEO a large enough equity share or bonus at the outset: If he gets 99% of firm value, this difficulty will probably be eliminated. But giving the CEO a large equity grant, share options, or bonus payment is very expensive. There is a tradeoff.

We assume that shareholders are able to set the compensation contract ex ante, before the CEO has started to formulate strategy. Thus, the contract consists of a specified payment in the event that the firm is worth V, and it can be renegotiated later when the strategy is decided, if doing so is mutually agreeable.[15]

Suppose that the initial contract is set at m^* (conditional on the event that the firm is worth V) and that renegotiation results in final compensation levels m_B^*, m_M^*, and m_D^* (in the event the firm is worth V) in each of the three possible combinations of feasible strategies that the manager may present to the shareholders following the strategy formulation stage.[16] Define

$$U_i^* \equiv m_i^* \pi_i - e_i. \tag{18}$$

Clearly, m_B^*, m_M^*, and m_D^* cannot be less than m^*; otherwise, the manager would not agree to renegotiate. Also, renegotiation will not take compensation to a higher level than it would have reached under ex post contracting:

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[15] We assume here that agents cannot precommit not to renegotiate, an assumption that is relaxed in Section II.B below.

[16] Although the set of possible histories is richer, it is clear that the contract could not distinguish between events such as: (i) the manager initially had a choice between M and D, but chose to investigate D; versus (ii) the manager initially had no choice, and D was the only option for change. Thus, the most that one could hope for is three final different payments m_B^*, m_M^*, and m_D^*. Even then, Proposition 3 shows that not all combinations of three positive real numbers are achievable.

PROPOSITION 3: *Ex ante contracting results in a floor m^*, such that*

$$m_B^* = \max\left\{m^*, m_B\right\},$$
$$m_M^* = \max\left\{m^*, m_M\right\},$$
$$m_D^* = \max\left\{m^*, m_D\right\}.$$

Proof: See Appendix B.

Note that ex post contracting can be viewed as a special case of ex ante contracting: If a low payment is set initially (at most $m^* = m_B$), it will simply be renegotiated upward to $m_B^* = m_B$, $m_M^* = m_M$, and $m_D^* = m_D$, where m_B, m_M, and m_D are the ex post contract payments derived in the previous section. Hence, we refer to this case simply as ex post contracting. We will reserve the term "ex ante contracting" for the case $m^* > m_B$.

The idea behind ex ante contracting is as follows (for ease of exposition, the full derivation is relegated to Appendix B). Suppose the CEO has a choice between strategy D, with compensation m_D, and strategy M, with compensation m_M. We know (from Section I.B) that he will prefer D, even though the effort is higher, because the compensation is much higher. Now increase the compensation for M up to the point at which he is just indifferent: That is, set m^* so that

$$U_M^* = m^* \pi_M - e_M = m_D \pi_D - e_D = U_D^*. \tag{19}$$

Note that m^* is lower than m_D, because D requires higher effort than M. Also, m^* is higher than m_M. We give the formula for m^* in Appendix B. Now, if the CEO starts off with an ex ante contract m^*, and it later turns out that there is no opportunity for change (scenario B), he simply implements B. Likewise, if the only opportunity for change is M (scenario BM), he will implement M. If the only opportunity for change is D (scenario BD), renegotiation occurs. The shareholders will agree to pay m_D and the CEO will choose to implement D. So far, these strategy choices are of course exactly the same as with ex post contracting; the only difference is that the shareholders have paid more to have strategies B and M implemented. The interesting case is scenario BMD: Now the CEO picks M with compensation m^*, as he has nothing to gain by picking D instead and renegotiating higher compensation m_D.

To determine whether shareholders will prefer ex ante contracting, we can compute their payoff, conditional on each of the four scenarios, and we can then compute the expected payoff averaging across the four scenarios and characterize the shareholders' preference in terms of the exogenous parameters of the model. This is done in Appendix B. However, more intuitively, we can refer to the above discussion of the four scenarios. This information is summarized in the third row of entries in Table I (entitled "ex ante contract"). These entries show the strategy chosen and the shareholders' payoff in each scenario. For comparison, the previous row of the table gives the corresponding information

Table I
Shareholders' Preferences Toward Different Types of Contracting in the Four Possible Scenarios of Strategy Availability

The columns correspond to different scenarios of available strategies. The first row (following the headings in the top row) shows the first–best strategy choice for each of the four scenarios of available strategy at the strategy formulation stage (this assumes condition (6) from the paper; otherwise the last column should show strategy D as first–best). The next three rows show the strategy choice and, underneath it, the shareholder payoff in each of the three contracting environments. Plus and minus signs indicate improvement or worsening relative to previous rows. Note that $m_B < m_M < m^* < m_D$.

| | Scenario | | | |
Available Strategies	B	BM	BD	BMD
First–best strategy	Strategy B	Strategy M	Strategy D	Strategy M
Ex post contract	Strategy B	Strategy M	Strategy D	Strategy D
	$\pi_B(V - m_B)$	$\pi_M(V - m_M)$	$\pi_D(V - m_D)$	$\pi_D(V - m_D)$
Ex ante contract: guaranteed minimum m^*	Strategy B	Strategy M	Strategy D	Strategy D
	$\pi_B(V - m^*)$	$\pi_M(V - m^*)$	$\pi_D(V - m_D)$	$\pi_M(V - m^*)$
	$(-)$	$(-)$		$(+)$
Precommitment: upper limit m_D	Strategy B	Strategy M	Strategy D	Strategy D
	$\pi_B(V - m_B)$	$\pi_M(V - m_M)$	$\pi_B(V - m_B)$	$\pi_M(V - m_M)$
			$(-)$	$(++)$

for ex post contracting. We can see that compared to ex post contracting, ex ante contracting makes no difference to the strategy choice in scenarios B and BM, but results in higher compensation. If these scenarios occur, ex ante contracting is worse for the shareholders. In scenario BD, ex ante contracting makes no difference to the shareholders, either in the strategy chosen or in pay. Finally, as shown in the last column, in scenario BMD, ex ante contracting helps the shareholders: The CEO chooses M instead of D.

This discussion shows that ex ante contracting, that is, commitment to high payment, will tend to be preferred to ex post contracting if scenarios BMD and BD are very likely (compared to scenarios B and BM). One could interpret this as a more changeable environment, or an environment in which a wider range of challenging strategic options are available. In terms of the parameters of the model, this corresponds to high p and low q_M. The exact conditions are given in Appendix B.

To summarize, in a highly changeable environment in which difficult strategies are likely, shareholders may guarantee the CEO an apparently overgenerous package of incentives at the outset. Although sometimes overgenerous relative to the immediate task at hand, it would improve incentives for strategic decision making.

B. Setting a Ceiling on Compensation

In this section, we consider the case in which the shareholders are able to make precommitments about the ex post renegotiation of the CEO's

compensation contract by setting an upper limit to compensation. The benefit of such a compensation scheme is to prevent the CEO from choosing to formulate his preferred strategy D over the shareholders' preferred strategy M. If he knows he will never be paid enough to implement an overambitious strategy, the CEO will lose interest in such a plan. Establishing ex ante a credible ceiling on compensation does have a drawback, however: Even when dramatic change is the only possible alternative to the status quo, it will be disregarded.

The issue of precommitment not to renegotiate is open to debate. Clearly, companies and CEOs often do renegotiate compensation. The typical arrangement consists of an annual salary combined with a stock option grant; so each year the salary is renegotiated and the CEO also adds more options to an existing portfolio. Hence, precommitment may seem unrealistic. Also, from a theoretical point of view, it is hard to see how commitment could be enforced—perhaps by a third party, but then, the design of the contract with this third party would have to be complex and might violate the spirit of our prior assumptions on contractibility between CEO and shareholders, and it would certainly be unrealistic.

However, perhaps social norms or individual ethics could be used as a precommitment device. For example, in Sweden it would probably be possible for a company to precommit never to pay the CEO over $1 billion (as was paid to Roberto Goizueta of Coca-Cola over a 10-year period). Even within the United States, 25 years ago such a payment might have been impossible. Thus, precommitment may be possible at the social level. At the level of the individual company, it may be possible to precommit by appointing individuals (such as Warren Buffett) who are known to be strongly opposed to high compensation to the board or to the remuneration committee. Having large block shareholders with this view might also have the same effect. For that reason, we believe it is worthwhile to explore the case in which precommitment is possible. We therefore add the following assumption: We consider the possibility of precommitting not to renegotiate. The precommitment we consider is an upper bound on the level of compensation.[17]

The optimal contract in this case is for shareholders to commit to a maximum payment m_M—in other words, they precommit to never pay enough to implement dramatic change, D (the derivation of the optimal contract is in Appendix C). The result is that the shareholders agree to payments of m_B for strategy B and m_M for strategy M (just as with ex post contracting). In case the CEO proposes strategy D, the shareholders still cannot offer above m_B, hence in scenario BD they agree instead to stick to strategy B with payment m_B.

While the full conditions under which this form of contracting is preferred are given in Appendix C, we now give an intuitive exposition of the tradeoffs by taking a case-by-case look at each of the four scenarios. To recall, these scenarios are: (i) Scenario B: strategy B is the only one available; (ii) Scenario

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[17] This statement rules out more complicated kinds of precommitment, which we consider unreasonable, such as: the shareholders commit never to offer a payment in a set A, and the set A can have an arbitrary shape such as a subset of the real line that is not connected, the set of rational numbers, etc. Recall that strategies are not contractible, hence the contract cannot be made contingent on the CEO's announced strategy.

BM: strategies *B* and *M* are available; (iii) Scenario *BD*: strategies *B* and *D* are available; and, (iv) Scenario *BMD*: all three strategies are available. The reader should refer to the last row of Table I, entitled "Precommitment: upper limit m_M," and compare it to the previous two rows.

The table shows that setting a maximum wage works well in scenarios *B, BM,* and *BMD*. The optimal precommitment is to a maximum of m_M, which will prevent payment of m_D in scenario *BMD*. More specifically, in scenarios *B* and *BM*, the first–best strategy is chosen, just as with ex post and ex ante contracting. Moreover, in those two scenarios, the lowest possible compensation is offered, just as it is with ex post contracting but in contrast to ex ante contracting where there is overpayment. In scenario *BMD*, again there is an advantage of setting a limit on compensation: The best strategy is chosen, as it is with ex ante compensation but unlike ex post compensation, and there is the further advantage compared to ex ante compensation that this is achieved with the lowest possible compensation. Finally, in scenario *BD*, we see the drawback of setting a limit on compensation: Because strategy *D* is effectively ruled out, the firm must revert to the inferior strategy *B*.

We can see that setting an upper bound would be optimal if it is unlikely that the strategy for dramatic change, *D*, is the only one available (low probability q_D) and if the overall probability of change (p) is also low. The exact conditions are given in Appendix C. We can interpret this case (low q_D and small p) as a relatively stable environment characterized by a low chance of dramatic change. In this case, the ceiling on compensation is a cheap way to correct the manager's preference for dramatic change. If this is not the case, then it will be preferable to set either an ex ante contract without a ceiling, or an ex post contract.

III. Related Literature

Our analysis can be used to interpret the available empirical evidence on top management pay in the United States. Hall and Liebman (1998) document that on average a 1% increase in a firm's stock price led to an increase of $124,000 in the CEO's wealth in 1994, while in 1998 this value exceeded $500,000. Murphy (1999) shows a sharp increase in pay–performance sensitivity over the early 1990s, reaching a level almost double the 0.325% reported in the seminal Jensen and Murphy (1990) article. Conyon and Murphy (2000) report similar findings for the United Kingdom, showing that both the level and the pay–performance sensitivity of CEO compensation increased sharply over the 1990s. One can interpret these studies on the 1990s as evidence of a period of high changeability and a commitment to high compensation ("ex ante contracting" in terms of our model).

Core and Guay (2001) describe the cross-sectional variation of executive compensation, finding that the median large firm has options outstanding that amount to 5.5% of common stock, rising to 10–14% for growth industries (computer, software, pharmaceutical) but only 2–3% for low-growth industries such as utilities and petroleum firms. Likewise, Murphy (1999) finds widespread use of stock options in most industry groupings, but not in utilities.

One can interpret this, again, as evidence of higher strategic discretion of CEOs and more changeable environments in growth industries. An alternative explanation, in line with standard agency theory, is that higher compensation in high-growth industries simply reflects higher agency costs of effort (or private benefits of control). Plausibly, however, while managerial jobs in growth industries may be more challenging and more onerous, this difference in effort seems unlikely to be large enough to explain very large divergences in compensation packages. Along the same lines as the findings of the above studies, Demsetz and Lehn (1985) and Core and Guay (2002) find a strong positive relation between firm risk and CEO pay–performance sensitivity.[18]

Core and Larcker (2003) examine firms with "target ownership plans" specifying the minimum amount of stock that must be held by executives and show that non-CEO executives typically hold much less equity (relative to base salary) than the CEO. We can interpret this as evidence that given the special role of the CEO, his incentives should be stronger to give good incentives in strategy formulation.

We now comment on the relation between this paper and some of the existing agency literature. First, there is the multitasking version of the principal-agent problem in which the agent has two tasks to which he can devote effort, but the output of only one of those tasks is measurable (Holmstrom and Milgrom, 1991). Making incentives more high-powered relative to that output measure can be counterproductive, reducing the agent's effort on the other task. There is a similarity with our model in that incentives for one variable (effort, in our model) can distort another variable (strategy choice). However, in our model both variables contribute to the same measured output (firm value). In our model, the analysis is driven by the incomplete nature of the contracting, the sequencing of the agents' choices, and the opportunities for renegotiation of the contract, all of which are absent from the multitasking model.

Free cash flow theory (Jensen (1986)) suggests that challenging strategies can be beneficial for CEOs in terms of private benefits. The private benefits are not explicitly modeled; they are exogenous. Rather than direct private benefits, we consider indirect benefits arising from the effect of managerial activity on compensation. Hence, while free cash flow theory is rather broader than our analysis, our paper could be viewed as compatible with free cash flow theory and as offering a rationalization of how private benefits can arise.

Shleifer and Vishny (1989) argue that managers have an incentive to entrench themselves by making investments that create specific human capital. They will favor projects that they alone can operate and that cannot easily be transferred to another manager, much like a computer programmer who writes a deliberately cryptic code that makes him or her indispensable and thereby able to extract rents. In our article, there is no specific human capital. Shleifer and Vishny's effects rely on the manager manipulating his position in the labor market, while the effects in our paper rely on manipulating the agency problem.

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[18] Core, Guay, and Larcer (2003) contains a detailed discussion of empirical evidence on this issue and its possible interpretations.

Prendergast (2002) considers a setting in which the agent has discretion in deciding how to solve the problem. He starts by noting that the majority of empirical studies find a positive relation between the risk of an agency problem and the strength of the agent's incentives, contrary to the predictions of the standard model. This empirical evidence is compatible with our analysis. He then points out that in reality, agents can decide how to go about solving a problem, which is similar to our point that CEOs decide strategy as well as implement it. He goes on to address issues different from the ones we address here, concluding that if a problem is uncertain, the principal will not know how to solve it and thus will allow the agent to determine the solution, motivating him or her with strong incentive pay. On the other hand, if a problem is predictable the principal will know how to solve it, and will instruct the agent with regard to what to do and then will verify compliance by directly monitoring his or her actions.

IV. Conclusion

Our results are simple to summarize. In this paper, we analyzed how managerial rent-seeking may distort strategy choice in favor of overambitious change. We showed that in our model:

- In an environment in which available strategies are likely to include difficult strategies (leading to disagreement with the CEO), the shareholders should commit to a policy of high pay, offering the CEO a high-powered incentive package at the outset in order to improve his incentives for strategy making, even if sometimes this results in excessive (in hindsight) payment at the implementation stage. This will correct the CEO's incentives away from excessively dramatic and hard-to-implement restructuring, and toward the kind of change that is preferred by shareholders.
- Another way of curbing a CEO's tendency toward dramatic change is to precommit never to pay the very high compensation package required to implement dramatic change. It may be difficult to make this precommitment, but if it is possible, then it will be preferred if dramatic change is not likely relative to moderate change, or if change is unlikely overall.
- Finally, in some situations it may optimal for the shareholders simply to accept some strategic distortion and to negotiate compensation to the required level after the strategy has been selected. This will occur when the existence of alternatives to the status quo is not very likely, or when shareholders do not have strong preferences regarding the possible change options.
- Our analysis can help to explain why CEOs typically receive much higher pay and stronger incentives than other senior managers. Their pay reflects strategic discretion more than direct compensation for effort. Our results are also consistent with the empirical evidence of higher incentives in more changeable environments, and in more recent years. Another possible explanation would be the "difficulty level" of likely strategies increasing over time.

- One can also hypothesize that the economic pressures in recent years for firms to transform and reinvent themselves have led to "ex ante contracting," that is a precommitment to high pay and incentives.

An alternative perspective on CEO pay is that high pay is not optimal at all for shareholders and simply results from rent extraction in collusion with the board. While we do not deny this possibility, we think it is worthwhile to explore how high pay can arise in a model with only relatively minor departures from standard agency theory.

Appendix A: Remarks on Incomplete Contractibility

The approach we take here applies what is now a standard paradigm, following many papers of the past decade that have studied financial contracting where some variables are observable by both parties, but are not contractible. Aghion and Bolton (1991), Hart (1995), and Hart and Moore (1990) are leading examples. In general, noncontractibility can arise because it would be too expensive or too complex to make contracts fully conditional, or because it would be difficult for a third party to verify fulfillment of the conditional clauses in the contract (since contracts depend on third parties such as courts or private arbitrators for enforcement). For example, Hart (1995) and Hart and Moore (1998) assume that investment is not contractible. They argue that even if third parties were able to verify monetary expenditures on investment, they would be unable to tell if the funds were applied properly to the right kinds of projects. This is similar to our assumption that strategy is noncontractible. Only "hard" variables are contractible.

To motivate our analysis, consider the following example. Suppose that a professor is given responsibility for a degree program. He or she can choose to run the program on a business-as-usual basis, that is, attend the usual committee meetings, check the lecturing performance of his or her colleagues, monitor the performance of the program office in regard to admissions and records, and take an appropriate interest in student welfare. This is a moderately time consuming, but manageable task and the professor would be entitled to expect some measure of compensation in the form of a reduced teaching load or a moderate salary supplement.

Now suppose the professor is tasked with restructuring the course with a freshly thought-out structure and syllabus that reflects current student demand and that is fully up to date. The first observation we make is that engineering such a change is extremely demanding in terms of time and energy. Many proposed changes, however trivial, will meet with resistance from entrenched lecturers. Even colleagues who are enthusiastic about change will respond by making a wide variety of counterproposals that make coordination on an improved outcome difficult. So, change from the status quo can be disproportionately costly and the professor, unless he obtains intrinsic satisfaction from the task, will not be keen to take on this job without substantial additional compensation (generally in universities, such extra compensation is unlikely!).

Of course, firms may not be quite as resistant to change as some universities but we argue that the same broad feature applies.

The second observation we make is that it may be easy to spot whether the changes made by a colleague are profound or superficial, but it may be hard to prove that assessment in a way that is credible to an outsider. A professor may feel that the course director's "relaunched" program is just a minor variant of the old one, but, if challenged on this view, it might be hard for him or her to convince a colleague in another department, a student, or the course director's lawyer. So it would be impossible to condition compensation on the successful implementation of a truly improved degree program. We argue that in businesses generally, similar reasons are likely to make it impossible to condition pay directly on strategy. However, in businesses, unlike universities, pay can be conditioned on share price.

To summarize the two key points of the example: First, change can require disproportionately high effort to implement, relative to the status quo; second, writing a contract conditional on "satisfactory change" is likely to be impossible.

In our model, we have in mind a variety of corporate strategies, of which a possible simple example would be the introduction of a comprehensive cost-cutting program. At first sight, it might seem that costs can be verified easily from the company accounts. However, this would be a crude way of monitoring the successful implementation of a genuinely shareholder-value increasing rationalization plan. It could likely be quite easy for the manager to slash costs with a poorly executed program of cutbacks that would actually damage shareholder value in the longer term (through employee morale, quality control problems, disruption of supplier relationships, etc). Just because a strategy has implications for an easily quantifiable variable, it does not mean that controlling that variable will actually verify implementation of the strategy.

Holmström and Milgrom (1991) give a good illustration of this kind of problem. A teacher in South Carolina was found to have boosted her class exam performance, and hence her own performance rating, by passing the children answers to the statewide geography test. Another egregious example is given in the *Financial Times* of February 4, 1994: The recently appointed chairman of Audi discovered that the previous year's sales figures had been "bolstered by an old trick. Audi France officials confirmed yesterday that 'several tens of thousands' of cars had been parked with French distributors [and hence recorded as sales], only to be shipped back to Germany last year. Since many of them lacked airbags and ABS (antilock brake system) braking systems—regarded as essentials in the Germany quality car market—selling them was no easy task." This example of "channel stuffing" shows why even apparently "hard" data such as company accounts may not be of much help in writing conditional contracts.

Appendix B: Ex Ante Contracting

This section of the appendix contains full details and derivations for the analysis given in Section II.A of the main text. The correct standard procedure

for solving an agency problem requires us to list all the possible actions of the agent, for each action to compute the cheapest way for the principal to induce the action, and then to compute the principal's resulting payoff. Finally, the principal must compare his payoff across actions and pick the optimal one. For this model, the action space of the agent is complex because the CEO needs to decide whether to choose M or D, if there is a choice, at the strategy formulation stage; whether to choose B or the alternative, if there is one, at the strategy choice stage; and whether to put in the required effort for the chosen strategy at the implementation stage. However, we can simplify matters by eliminating actions such that the CEO does not put in effort (as shown in Appendix D), and can specify the relevant actions by describing the choices of strategy at the formulation stage and at the implementation stage. The list and full description of the eight such actions is given in Appendix D, where we also show that six of these can be eliminated from consideration here (ex ante contracting) because they involve ex post inefficient strategy choices. The two remaining actions are what we call:

- *Moderate Change Favored*: The manager selects M over D if there is a choice at the strategy formulation stage (scenario BMD), and this is then chosen for implementation over B. If M is the only alternative at the strategy formulation stage (scenario BM), it is chosen for implementation over B, likewise for D (scenario BD).
- *Dramatic Change Favored*: The manager selects D over M in scenario BMD at the strategy formulation stage, and this is then chosen for implementation over B. In scenario BM, M is chosen for implementation over B, likewise for D in scenario BD.

PROPOSITION 4: *The cheapest way to implement Dramatic Change Favored is ex post contracting.*

Proof: Ex post contracting gives this action in return for contractual payments (in the event of firm value V) $m_B^* = m_B, m_M^* = m_M, m_D^* = m_D$. If any of these payments were reduced, the manager would not be willing to work to implement the specified strategy B, M, or D; therefore, this is the cheapest way to induce the action.   Q.E.D.

The next proposition will rely on Proposition 3 from the main text, so we first give that proof.

Proof of Proposition 3: We show that $m_B^* = \max\{m^*, m_B\}$; a similar argument holds for the other two cases, BM and BD. Let the ex ante contract specify a payment m^* in the event the firm succeeds and is worth V. First note that if renegotiation occurs, it will occur upward only, otherwise the CEO will reject the proposal. Hence $m_B^* \geq m^*$. Next, note that the renegotiated payment cannot exceed the ex post contracting level, otherwise the shareholders could offer less and achieve the same behavior from the CEO.

Suppose first that $m^* \geq m_B$, then it is clear we cannot have renegotiation and $m_B^* = m^*$.

Next suppose that $m^* < m_B$, then it is clear (from the derivation of m_B) that renegotiation is mutually beneficial and will lead to a contractual payment $m_B^* = m_B$.   Q.E.D.

PROPOSITION 5: *The cheapest way to induce Moderate Change Favored is ex ante contracting with $m^* \in (m_M, m_D)$ given by*

$$m^* = \frac{\pi_D \left(\dfrac{e_D - e_B}{\pi_D - \pi_B} \right) - (e_D - e_M)}{\pi_M}. \tag{B1}$$

Proof: To induce this action, we obviously cannot drop m_B^* below m_B, m_M^* below m_M, or m_D^* below m_D, otherwise the CEO will not be willing to work to implement the chosen strategy. We have to increase one or more of the contractual payments above the ex post level by setting $m^* > m_B$, to see if this will induce the agent to pick M over D and if so, find the smallest m^* that does this. The question is whether it is optimal to have $m^* \in (m_B, m_M]$, $m^* \in (m_M, m_D]$, or $m^* > m_D$.

In the event the CEO has a choice between M and D at the strategy formulation stage, his expected payoff if he picks M is $(\pi_M m_M^* - e_M)$; if he picks D, it is $(\pi_D m_D^* - e_D)$. Since ex post contracting induces the choice of D, it follows that $m^* \in (m_B, m_M]$ will not induce the choice of M because increasing m^* from m_B part-way toward m_M does not affect either of these payoffs. Next, consider $m^* > m_M$. If $m^* \in (m_M, m_D]$, the CEO will just be willing to pick M over D if

$$\left(\pi_M m_M^* - e_M \right) = \left(\pi_D m_D^* - e_D \right). \tag{B2}$$

By hypothesis $m_M^* = m^*$ and $m_D^* = m_D$, so substituting for $m_D = \frac{e_D - e_B}{\pi_D - \pi_B}$, we have

$$m^* = \frac{\pi_D \left(\dfrac{e_D - e_B}{\pi_D - \pi_B} \right) - (e_D - e_M)}{\pi_M}. \tag{B3}$$

One can verify that m^* defined by this formula does not exceed m_D, as a consequence of our assumption that $\frac{e_D}{e_M} > \frac{\pi_D}{\pi_M}$ (or equivalently, $m_M < m_D$).   Q.E.D.

We can now complete the solution of the problem by examining the shareholders' preferences. If the shareholders induce choice of *Moderate Change Favored* using ex ante contracting with m^* as just derived, their expected payoff (averaging across all four scenarios) is

$$(1 - p)(V - m^*)\pi_B + p(1 - q_D)(V - m^*)\pi_M + pq_D(V - m_D)\pi_D. \tag{B4}$$

If instead they just accept ex post contracting to induce choice of *Dramatic Change Favored*, their expected payoff is

$$(1 - p)(V - m_B)\pi_B + pq_M(V - m_M)\pi_M + p(1 - q_M)(V - m_D)\pi_D. \tag{B5}$$

It follows immediately that:

PROPOSITION 6: *The shareholders will use ex ante contracting with a guaranteed minimum m^* (paid in the event of success) to induce the CEO to prefer Moderate Change Favored if*

$$p(1 - q_M - q_D)(V - m^*)\pi_M \geq p(1 - q_M - q_D)(V - m_D)\pi_D$$
$$+ (1 - p)(m^* - m_B)\pi_B$$
$$+ pq_M(m^* - m_M)\pi_M. \qquad (B6)$$

This ex ante contracted payment m^* will be renegotiated upward to m_D in the event that the CEO has no choice over available strategies and presents D to the shareholders.

If the inequality is reversed, they will prefer the ex post contract implementing Dramatic Change Favored.

This expression has a simple intuitive explanation. The term on the left-hand side represents the shareholders' payoff when the CEO chooses to formulate M over D, which is the benefit of a regime of ex ante contracting. For this to be desirable, it must be greater than the payoff when the CEO makes the opposite choice (the first term on the right-hand side (RHS)). But it must also compensate the shareholders for two drawbacks associated with ex ante contracting: (i) the shareholders will have to overpay the CEO (relative to the ex post levels) for implementing strategy B when there are no alternatives to it (the second term on the RHS); and, (ii) they will also overpay the CEO (relative to the ex post levels) for implementing strategy M, even when dramatic change D is not a real threat (third term on the RHS).

Appendix C: Setting a Ceiling on Compensation

This section of the appendix contains full details and derivations for the analysis given in Section II.B of the main text. We consider an ex ante contract with a precommitment to an upper limit for compensation; during the renegotiation stage, this upper limit will be binding. Clearly, this will not help implementation of the two actions previously analyzed in Appendix B (*Moderate Change Favored* and *Dramatic Change Favored*), because they require a high payment for strategy D. The interesting case now is the possibility to implement another action which we call *Moderate Change Only*.[19] This action is characterized by choosing M whenever it is available and ignoring D even if it is the only alternative to B. The shareholders can correct the manager's preference for D by committing themselves never to pay enough compensation to make the CEO willing to implement that strategy. This therefore requires $m'_B \geq m_B$, and $m'_M \geq m_M$ but not $m'_D \geq m_D$ (where m'_i is the final payment made

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[19] Denoted by action A7 in Appendix D. In that Appendix, we also show that the remaining five actions, A2, A3, A4, A6 and A8, are not optimal.

to the CEO in the event of success given that he chooses to implement strategy i). So the cheapest way to implement this action is to precommit to never pay more than m_M. Hence, $m'_B = m_B, m'_M = m_M$, and $m'_D = m_M$. The expected payoff for the shareholders is

$$(1 - p)\pi_B(V - m_B) + pq_D\pi_B(V - m_B) + p(1 - q_D)\pi_M(V - m_M). \quad \text{(C1)}$$

We can compare this expected payoff to what shareholders would obtain in the case that the contracting process involved ex ante contracting without precommitment, and also in the case that we had an ex post contracting policy. From these comparisons we reach the following results.

PROPOSITION 7: *The shareholders will prefer ex ante contracting with a ceiling on compensation (inducing the CEO to choose Moderate Change Only) to ex ante contracting with unrestricted renegotiation if:*

$$\pi_B(1 - p)\big(m^* - m_B\big) + p(1 - q_D)\pi_M\big(m^* - m_M\big) \geq pq_D[\pi_D(V - m_D) \\ - \pi_B(V - m_B)], \quad \text{(C2)}$$

with m^* as defined in Proposition 5.

Proof: Direct from the comparison of the shareholders' expected payoff with ex ante contracting with a ceiling (equation (C1)) and without an upper bound (equation (B4)). Q.E.D.

PROPOSITION 8: *The shareholders would prefer the ex ante contract with a ceiling (inducing the CEO to choose Moderate Change Only) to ex-post contracting if:*

$$pq_D[(V - m_B)\pi_B - (V - m_D)\pi_D] \geq p(1 - q_M - q_D)[(V - m_M)\pi_M \\ - (V - m_D)\pi_D]. \quad \text{(C3)}$$

Proof: Direct from the comparison of the shareholders' expected payoff with ex ante contracting with a ceiling (equation (C1)) to their expected payoff with ex post contracting (equation (B5)).

If both conditions (C2) and (C3) are satisfied, the shareholders would prefer to rule out the possibility of the manager formulating strategy D by precommitting to a ceiling on compensation. Q.E.D.

Appendix D: List of Actions

We start by showing that we only need to consider actions such that the CEO puts in effort.

LEMMA 1: *Under an optimal contract, the CEO always puts in the required effort for the chosen strategy.*

Proof: Consider first the case of ex post contracting and the possibility that in the event that B is the only available option, the CEO does not put in the

required effort, e_B (implying $m_B^* < m_B$). By our assumption that $V > m_B$, this is suboptimal because the shareholders would prefer to pay m_B and induce effort. The cases BM and BD are similar given our assumptions that the parameters satisfy condition (4). In the case of ex ante contracting, the same reasoning applies.

In the case of a ceiling on compensation, we know that the ceiling would never be below m_B, by our assumption that $V > m_B$. Therefore, if the manager moves away from implementing B with effort, it must be in order to implement another strategy with effort.   Q.E.D.

We can list the actions as follows:

A1: (D, M_{BM}, D_{BD}) *Dramatic Change Favored*
A2: (D, B_{BM}, D_{BD})
A3: (D, M_{BM}, B_{BD})
A4: (D, B_{BM}, B_{BD})
A5: (M, M_{BM}, D_{BD}) *Moderate Change Favored*
A6: (M, B_{BM}, D_{BD})
A7: (M, M_{BM}, B_{BD}) *Moderate Change Only*
A8: (M, B_{BM}, B_{BD}).

To explain the notation, take the first action on the list, (D, M_{BM}, D_{BD}), which represents the outcome of ex post contracting. The first symbol, D, means that when the manager has a choice between M and D at the strategy formulation stage (scenario BMD, with probability $p(1 - q_M - q_D)$), he picks D. The second symbol, M_{BM}, means that at the strategy implementation stage when there is a choice between B and M, he picks M—note that this is relevant because even if he picks D in preference to M at the strategy formulation stage when he has the choice, there will sometimes (scenario BM, with probability q_M) be occasions when M is the only option. The third symbol, D_{BD}, means that at the strategy implementation stage when there is a choice between B and D, he picks D.

The three actions that are referred to in the text are A1 (Dramatic Change Favored), A5 (Moderate Change Favored), and A7 (Moderate Change Only).

For the purposes of the analysis in Sections I.B and II.A (i.e., the main analysis on ex post contracting and ex ante contracting), we can rule out actions A2–A4 and A6–A8 as suboptimal, because renegotiation would always take place to implement the change strategy (M or D) rather than the status quo B by our assumptions on the exogenous parameters satisfying condition (4). The argument is similar to the previous proposition. That leaves action A5 (Moderate Change Favored, which corresponds to the manager choosing to investigate M rather than the more dramatic D) in addition to A1 (Dramatic Change Favored).

For the extension to the analysis of precommitment in Section II.B, we cannot exclude actions simply because they are ex post suboptimal—after all, the purpose of precommitment is precisely to improve ex ante incentives by allowing ex post inefficient actions in some outcomes. However, one can readily see that A2 and A6 are inferior to A1, A3 is inferior to A7, and A4 and A8 are inferior to all three actions A1, A5, and A7. That leaves A1, A5, and A7 as analyzed in the previous sections.

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