Optimal Corporate Governance Structures*

Andres Almazan[y] Javier Suarez[z]

University of Texas CEMFI and CEPR

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Abstract

This paper explores how motivating an incumbent CEO to make investments that improve the effectiveness of the firm organization under his management interacts with the replacement policy of the board of directors. We characterize the optimal compensation package (including severance pay) under governance structures that differ in the power that the incumbent CEO has on the board of directors. We explain why yielding the incumbent CEO some control of the board (entrenchment) can be desirable and offer predictions on when this arrangement is optimal. We also examine the correlation between the elements of his compensation package and the structure of the board.

[y]Department of Finance, University of Texas at Austin, TX, 78712-1179, e-mail: andres.almazan@bus.utexas.edu.

[z]CEMFI, Casado del Alisal 5, 28014 Madrid, Spain, e-mail: suarez@cemfi.es.

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1 Introduction

There are substantial differences in the control exercised by corporate boards of directors. In some cases the board can and does fire the CEO at will. However, in other corporations, the board is effectively the puppets of the CEO and exerts power only in extreme situations. The ideal control system, espoused in much of the governance literature, is one where a board of directors, which is accountable to shareholders, controls the corporation. This, however, ignores some important interactions between managerial incentive problems and shareholder activism which we explore here.

We consider a basic corporate governance problem: How to induce a CEO prone to entrenchment to improve the effectiveness of the firm organization while preserving enough governance flexibility to benefit from a potentially valuable replacement. We examine how the allocation of control in the board of directors and various aspects of the CEO's compensation can be used to address this problem.

Some of the questions that we consider are: Should shareholders keep total control of the board of directors or should they yield some control to the CEO? How does CEO compensation relate to these different board structures? Which roles do the different parts of the compensation policy play in inducing management to improve the effectiveness of the firm organization and in inducing a selective policy on CEO replacement?

Formally we develop a simple model of a corporation in which an incumbent CEO must make private investments to improve the effectiveness of the organization under his management. Examples of these investments are the building of a management team, the development of a certain corporate culture or the establishment of linkages with other firms based on the CEO's personal relationships. In each case the investments are costly for the CEO to make, are not contractible, and their benefits may be linked to the CEO's tenure in the firm. After making the investments, a rival CEO, who can improve either modestly or substantially the firm, may become

available. Within this setting we discuss the optimal corporate governance structure, which consists of the optimal CEO compensation and replacement policies.

In our model the presence of control rents plays a central role in determining the ¯rm's corporate governance structure. On the one hand, control rents generate a con°ict between the shareholders and the CEO on his replacement. On the other hand, by interacting with monetary incentives, control rents a®ect the optimal structure of CEO compensation. Consequently, the ¯rm's governance structure must take into account the interactions between compensation and replacement when addressing both the incentive problem present in the CEO's investment decision and the potential con°ict on CEO replacement.

To implement the optimal compensation and replacement policies we consider two board structures {\independent" and \CEO-controlled"{ that di®er in the power held by the incumbent CEO and are complemented by managerial compensation contracts that include performance-based rewards and severance pay. With independent boards there is a time-inconsistency problem since shareholders may ex post want to replace the incumbent more frequently than what would be desirable from the point of view of his ex ante incentives to invest. With CEO-controlled boards this problem disappears but instead the possibility of entrenchment (opportunistic resistance to step down) emerges. In both cases severance pay can play an important, albeit di®erent, role. In independent boards it helps shareholders to commit to a \softer" replacement policy and thereby solves the time inconsistency problem. In CEO-controlled boards it helps them to reduce the resistance of the incumbent CEO to step down and let his rival take over when the rival can make signi¯cant improvements.

We show that, despite the possibility of entrenchment, yielding control to the CEO can substantially reduce the need for expensive performance compensation. This advantage arises because the entrenched CEO can obtain part of his pay by negotiating an attractive severance package. Since the CEO negotiating power is higher if he has

previously taken actions that improve the effectiveness of the organization, this part of his compensation will be higher if his effort is higher. As we show, by linking rewards directly to actions (rather than the noisy signal of them given by performance), this feature helps to reduce the total cost of incentive compensation. Consequently, shareholders may find that a CEO-controlled board is ex ante optimal.

The analysis produces a rich set of practical and empirical implications. First we identify the circumstances that favor the desirability of CEO-controlled boards vis-a-vis independent boards. Everything else equal, we predict that CEO-controlled boards dominate when standard performance compensation is not very effective (e.g., because of a too noisy linkage between managerial decisions and corporate performance) and when entrenchment temptations are not very strong (e.g., because managerial control rents are small). Secondly we find that severance pay is more likely to be used and will tend to be larger in CEO-controlled boards than in independent boards, while the sensitivity of pay to performance will generally be lower in the former than in the latter. Moreover, if corporations differ in the size of their managers' control rents, severance pay and performance-based compensation will appear as substitutes (negatively correlated) across independent boards and as complementary (positively correlated) across CEO-controlled boards.

We conclude the analysis considering the effects of takeovers, and takeover threats, on the corporate governance system. Takeovers are redundant under an independent board {shareholders already have full control of the replacement decision{ but may undermine the CEO's power to resist his replacement under a CEO-controlled board. Strong takeover threats, which effectively leave the CEO replacement decision in shareholders' hands, would preclude governance through CEO-controlled boards. Moderate takeover threats, however, may improve the performance of a CEO-controlled board since, as we show, they may allow a selective replacement policy even without severance pay.

Our analysis is related to various strands of the literature on corporate governance. First it relates to work on boards of directors, that has also focused on their role in replacing managers. Hirshleifer and Thakor (1994) study the substitutability between the disciplinary roles of the board of directors and the takeover market under different degrees of directors effectiveness in assessing management quality. Maug (1997) examines the substitutability between boards and capital structure as instruments for corporate restructuring. Hermalin and Weisbach (1998) study the dynamics of board composition taking into account the power of the incumbent CEO in selecting and retaining board members, thereby creating endogenous entrenchment. Also Adams (1998) and Warther (1998) have centered their analysis on information problems and the ex post efficiency of the replacement decision. Instead we stress the ex ante incentive and commitment problems concerning this decision.

Our paper also relates to the literature on managerial compensation. Our main finding {that CEO-controlled boards can lead to renegotiations that allow shareholders to reduce the performance sensitivity of compensation contracts{ elaborates on a point first made by Holmstrom (1979) about the desirability of making incentive compensation contingent on any piece of information related to managerial actions. Our CEO-controlled board can help to solve the incentive problem partly because renegotiation makes the incumbent manager's final compensation contingent on his previous investment decision. This insight is thus similar to Scharfstein (1988), who argues that takeovers can create value for shareholders by implicitly making managerial compensation depend on the raider's information about the firm.

We also revisit some of the insights from the literature on the time inconsistency problem associated with shareholders' control of decisions affecting the manager's tenure. For instance, Stein (1988) shows that protecting managers from excessive takeover pressure may improve their incentives to undertake long-term investments. Titman (1984) and Dewatripont and Tirole (1994) examine the role of capital struc-

ture in the context of the ¯rm's liquidation and/or reorganization policy. Berkovitch and Israel (1996) consider its role in the speci¯c context of managerial replacement. They notice that, if replacing the existing manager involves an increase in risk, then leverage as well as the introduction of some \conservative" debtholders on the board of directors provide means to ¯ne tune the aggressiveness of shareholders' replacement policy. A similar reasoning leads Berkovitch, Israel, and Spiegel (1998) to analyze capital structure in interaction with managerial compensation. In our paper, the time inconsistency problem shapes the optimal compensation contract under an independent board, where severance pay in particular plays a role similar to debt in the last two papers.

Finally, our discussions on the role of severance pay in independent boards and under takeover threats relate to the abundant literature that has shown the potentially value enhancing e®ect of takeover defenses, including Knoeber (1986), the abovementioned Stein (1988), Harris (1990), Berkovitch and Khanna (1990), Israel (1991), Israel (1992), and Sarig and Talmor (1997). We complete the picture on the di®erent uses of severance pay by showing its utility to shareholders also in the case of CEO-controlled boards, even without takeover threats.

The rest of the paper is organized as follows. Section 2 describes the model. Sections 3 and 4 characterize the optimal CEO compensation and the replacement policies corresponding to an independent board and a CEO-controlled board, respectively. Section 5 compares both types of board, discusses the factors that determine the optimality of one or the other, and derives the main empirical implications of the analysis. Section 6 introduces takeovers. Section 7 concludes.

2 The Model

2.1 Agents, technologies, and the replacement decision

We consider a ¯rm that operates in a risk neutral economy where the market rate of return is normalized to zero. The ¯rm has a project that yields a terminal cash °ow x which equals R in case of success and 0 in case of failure.[1] The probability of success depends on the e®ectiveness of the ¯rm organization under the manager in charge. The ¯rm is initially run by an incumbent CEO who, in some circumstances, can be replaced with a rival manager. Managers have no wealth, are protected by limited liability, and their reservation utilities are zero.[2]

The probability of success under the incumbent CEO and under his rival are denoted by p and q, respectively. The incumbent CEO can increase the probability of success under his management from p_L to $p_H = p_L + ¢$ by undertaking a costly ¯rm-speci¯c human capital investment (e.g., by devoting e®ort to building an e®ective management team). This investment has a private utility cost B.

After the incumbent CEO has determined p, the uncertainty about the discovery of a rival manager is resolved. We think of q as a characteristic that relates to the rival's ability or some unmodelled human capital investment that will determine the e®ectiveness of the ¯rm organization under his management. If a rival is discovered, a replacement decision must be made in order to determine whether the incumbent CEO continues running the ¯rm (r = 0) or is replaced with his rival (r = 1). To

[1] The assumption that x = 0 in case of failure is made without loss of generality. Removing it would simply add innocuous constants to shareholders' expected payo®s.

[2] Under risk-neutrality, incentive problems make managers appropriate positive net expected payo®s due to wealth constraints and limited liability. These payo®s imply an incentive-related cost to the ¯rm when they exceed managers' reservation utilities. Assuming that reservation utilities are zero help us stressing the importance of this cost in determining the ¯rm's optimal corporate governance structure.

create a possible con°ict between the incumbent and the shareholders on this decision, we assume that if the incumbent is in charge up to termination, he receives a non-transferable control rent $C > 0$. Thus shareholders who only care about transferable cash °ows face an incumbent who also cares about his non-transferable control rent. The con°ict will show up whenever the incremental expected cash °ow associated with replacing the incumbent is not high enough to compensate for C, that is, $(q - p)R < C$. In these cases, whether the incumbent CEO ends up replaced or not will depend on whether the shareholders have total control of r or the incumbent CEO can somehow block his own replacement.

The Coasian argument whereby e±cient renegotiation will lead to internalize the "loss" of C does not necessarily work because the incumbent manager has no wealth. In particular, when shareholders have total control of r it is possible that the incumbent would be willing, but is unable, to "pay" in order to keep C, so he ends up replaced. In contrast, if he can block his own replacement, he may always decide to remain in charge.

We capture both the possibility and the absence of con°ict on the replacement decision by considering that three mutually exclusive events may occur. With probability π_0, no rival manager is available; with probability π_L, there is a rival with $q = q_L > p_H$; with probability π_H, there is a rival with $q = q_H > q_L$. Moreover, we assume that the con°ict only arises when the incumbent chooses p_H and the rival brings q_L. Formally,

$$p_L R + C < q_L R < p_H R + C < q_H R: \tag{1}$$

Hence, on cash °ow grounds shareholders will prefer q_L to p_H, while the incumbent, even if he is o®ered the whole cash °ow gain from his replacement, $(q_L - p_H)R$, will rather prefer to keep his control rent C.

2.2 Information and contracting

The contracting possibilities are limited by veri¯ability problems. The decision p of the incumbent CEO and the quality q of the rival manager, when available, are observable to the parties involved in the renegotiation on replacement. Yet we assume that p and q are not (directly or indirectly) veri¯able, so contracts cannot directly set a compensation scheme or a replacement rule contingent on p and q. In contrast, the replacement decision r and the terminal cash °ow x are veri¯able.

We assume that shareholders are interested in inducing the incumbent manager to invest.[3] Hence contracts have to tackle two problems. First, the moral hazard problem: they have to provide the incumbent with incentives for p_H. Second, the problem of implementing an adequate replacement policy: they have to induce the replacement of the incumbent whenever this creates value for shareholders. The unveri¯ability of $(p; q)$ leads to solve these problems by allocating control rights on the replacement decision r and by establishing a compensation scheme contingent upon the veri¯able contingencies $(r; x)$. We will refer to the optimal mix of explicit compensation and allocation of control rights as the ¯rm's optimal corporate governance structure. We focus on compensation schemes of the form $(w; s)$ that pay a bonus w if the incumbent is not replaced and the project succeeds, and a severance pay s if he is replaced;[4] compensation for the case in which the incumbent is not replaced and the project fails is set at its optimal value of zero. The possible allocations of control rights over r are discussed below in the context of the renegotiation where they become relevant.

[3] At the end of Section 3 we provide the su±cient condition (10) for this to be the case.

[4] For simplicity we assume that the severance pay is s no matter the project succeeds or fails. Considering a performance-based s would complicate the analysis by adding a third dimension to the contracting problem, but it would not qualitatively change our results.

2.3 Renegotiation and the board of directors

Since the contracts just described are not fully contingent on relevant pieces of information (specifically, q), there will generally be renegotiation between the incumbent CEO and the shareholders once this information arrives. We think of the board of directors as the institution that conducts these renegotiations. In most firms, the board has the authority of the shareholders to replace the CEO and nominate a successor. Nevertheless, the board typically hears the CEO in charge before making any important decision and, very often, some or even a majority of directors, though formally intended to represent the interest of shareholders, are members of the incumbent management team. Hence, there are many conceivable degrees of alignment between the positions of the board and the shareholders.

We assume that when a rival manager is discovered, the board meets with the incumbent CEO in order to bargain on his possible replacement. The outcome of these negotiations is a replacement decision and, possibly, new terms for the compensation of the incumbent {say, a new bonus w' if he remains in charge or a new severance pay s' if he steps down in favor of his rival. We model these negotiations as a simple one-stage bargaining game between the incumbent and the shareholders in which the former makes a take-it-or-leave-it offer to the latter.[5]

Thus, the initial contract will affect the outcome of the renegotiations by determining the threat points (or status-quo payoffs) of each party. We are considering two cases. In an independent board the residual right of control of the replacement decision is fully allocated to a representative of the shareholders. In contrast, in a CEO-controlled board, the shareholders still have the formal initiative on replacement, but the incumbent CEO can effectively veto his own dismissal, which thereby can only

[5]Our results also hold if with probabilities γ and $1-\gamma$, that represent the (exogenous) bargaining powers of each party, one party takes the initiative and makes a take-or-leave-it offer to the other party.

take place under his consent.[6]

2.4 Sequence of events

The following time line summarizes the sequence of events in the model.

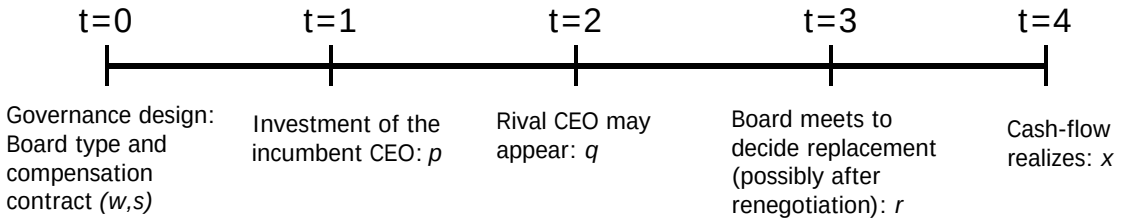

Figure 1. The sequence of events

We can distinguish ¯ve dates, $t = 0; 1; 2; 3; 4$. At $t = 0$ shareholders design a corporate governance structure, that is, de¯ne the residual rights of control of the replacement decision r and a compensation scheme $(w; s)$ for the incumbent CEO. At $t = 1$ the incumbent makes an investment decision p that determines the e®ectiveness of the organization under his management. At $t = 2$ the uncertainty concerning the discovery and type of a rival is resolved. (We will henceforth use $q = 0$ to represent the case where no rival is discovered.) At $t = 3$ having observed p and q; renegotiation on replacement takes place at the board of directors. The outcome of the renegotiation is a replacement decision r and the ¯nal compensation scheme $(w^0; s^0)$ for the incumbent. Finally at $t = 4$ the terminal cash °ow x realizes and the compensation to the incumbent is enforced according to $(w^0; s^0)$.

[6] In practice the replacement decisions of the board of directors can be \controlled" by the CEO in the above sense if there is a majority of loyal directors who are willing to vote against his dismissal.

3 The Independent Board

This section studies the functioning of corporate governance and the design of CEO compensation when the residual right to replace the incumbent CEO is fully allocated to the shareholders. We try to capture the operation of a board of directors in which, if there is no agreement on doing the opposite, the directors that represent shareholders' interest are strong enough to impose their preferred replacement decision.

We want to find the compensation scheme $(w; s)$ which is optimal in this case. Before starting, it is convenient to clarify the trade-offs in place. There is a moral hazard problem that interacts with the replacement decision. The issue is to provide incentives for p_H at a minimum compensation cost to shareholders. When $(p; q) = (p_H; q_L)$ the gain in expected cash flow associated with replacing the incumbent does not exceed the control rent C that he loses. Then, while ex post shareholders may have no reason to care about C; ex ante they might be willing to give up the incremental expected cash flow that would associate with q_L if by allowing the manager to keep C they could save enough on expected pecuniary compensation. The reason why this may actually be the case is that with $(p; q) = (p_L; q_L)$ the final replacement decision would always be $r = 1$ (see assumption (1)) so the incumbent may internalize that investing to improve the effectiveness of his organization increases by μ_L his probability of keeping C:

But how can shareholders commit not to replace the incumbent once his investment is sunk and a rival manager has become available? In our contracting framework, a properly chosen severance pay s provides the solution to this time inconsistency problem: it can dissuade shareholders from replacing the incumbent, but only if $(p; q) = (p_H; q_L)$. Unfortunately, a positive s has the undesirable effect of increasing the cost of replacing the incumbent when $q = q_H$: As a result, a trade-off emerges between the net savings associated with a lower w and the costs of, first, forgoing the potential cash flow gains when $q = q_L$ and, secondly, paying a positive severance

pay s when $q = q_H$: This trade-o® allows us to identify the circumstances in which a positive severance pay may be an ingredient of the optimal compensation scheme under an independent board.

For the formal analysis, we proceed backwards. We start looking at the renegotiation stage in order to characterize the replacement outcome associated with a given contract $(w; s)$ under each pair $(p; q)$. We study later how the contract a®ects the investment incentives of the incumbent CEO. Finally, we compute the value of the ¯rm to its shareholders and determine which contract is the best.

3.1 Renegotiation and the replacement decision

Consider a given initial compensation contract $(w; s)$ at the stage where p has already been chosen and a rival manager with $q = q_L; q_H$ has been discovered. A non-trivial replacement decision r has to be made, possibly after the renegotiation of the initial compensation scheme. When the incumbent manager and the representatives of the shareholders meet at the board of directors, they know that if no successful agreement is reached, the decision will correspond to the latter.

We denote the (hypothetical) replacement decision of the shareholders in case of no agreement by d. Clearly shareholders would keep the incumbent manager $(d = 0)$ if and only if the expected cash °ow that he can generate net of the bonus w that he would receive in case of success, $p(R ¡ w)$; is larger than the expected cash °ow that the rival can generate net of the severance pay s that the incumbent would receive if replaced, $qR ¡ s$: This condition is equivalent to

$$s ¸ pw + (q ¡ p)R: \tag{2}$$

If the inequality is reversed then shareholders would make $d = 1$. Importantly, setting a severance pay that does (not) satisfy condition (2) simply determines $d = 0$ $(d = 1)$ as the threat point of the incumbent and the shareholders when renegotiating the

initial compensation scheme. The ¯nal decision on r will di®er from d in those cases where adopting a di®erent replacement decision can be mutually bene¯cial to both parties.

By examining the various renegotiation possibilities, we get the following result. All proofs are in the Appendix.

Proposition 1 With an independent board, the renegotiations about the replacement of the incumbent manager under an initial contract $(w; s)$ and a given pair $(p; q)$ will yield the following outcome:

1. When $(q ¡ p)R > C$; the replacement decision is $r = 1$ and the expected pecuniary compensation to the CEO is $W = \min\{w + (q ¡ p)R; s\}$:

2. When $(q ¡ p)R \cdot C$; there are two possible cases:

   (i) if $s < (q ¡ p)R$; then $r = 1$ and $W = s$;

   (ii) if $s \geq (q ¡ p)R$; then $r = 0$ and $W = \min\{w; s ¡ (q ¡ p)R\}$:

Proposition 1 con¯rms that $(q ¡ p)R \cdot C$ is a necessary condition for the incumbent manager to keep his job; otherwise, the incumbent manager and the shareholders can reach an agreement whereby both bene¯t from the replacement of the incumbent. But $(q ¡ p)R \cdot C$ does not su±ce for $r = 0$: Ex post shareholders do not care about C; but only about cash °ow. They only \internalize" C if a severance pay s of at least $(q ¡ p)R$ absorbs all the potential cash °ow gain from $r = 1$: In contrast, the replacement outcome does not depend on the size of the bonus w. This asymmetry re°ects the operation of the manager's wealth constraint as well as the fact that the board is independent (shareholders fully control the \default" replacement decision d). For example, suppose $(q ¡ p)R \cdot C$ and $s \geq (q ¡ p)R$; then if w is too high, the renegotiation will make w' low enough to guarantee the continuation of the CEO. However, if $(q ¡ p)R \cdot C$ but $s < (q ¡ p)R$; the incumbent CEO will be unable

to keep control on the project because shareholders will ¯nd privately pro¯table to choose $d = 1$ and the CEO has no money (nor enough concessions in w to make) with which to convince them to do otherwise.

Notice that under assumption (1) $(q - p)R \cdot C$ only holds in the case $(p; q) = (p_H; q_L)$: Hence, this is the only case in which the replacement decision will depend on the severance pay s set in the initial contract. With $p = p_L$ or $q = q_H$; the incumbent CEO will end up replaced, irrespectively of $(w; s)$.

Proposition 1 fully characterizes r and W in those cases in which a rival manager becomes available. The outcome when no rival manager is discovered ($q = 0$) is much simpler: no replacement takes place and $W = pw$; following the terms of the initial contract.

3.2 CEO incentives and the initial contract

When deciding on investment, the incumbent CEO anticipates the replacement decision r and the expected pecuniary compensation W that will follow, perhaps after renegotiation, each pair $(p; q)$. The incumbent will choose p_H only if by doing so the increase in his expected pecuniary income W and non pecuniary income C (received if $r = 0$) exceeds the private cost B of his decision. Compactly written, this incentive compatibility condition reads

$$E_q[W + (1 - r)C| p_H] - E_q[W + (1 - r)C| p_L] \geq B: \tag{3}$$

Proposition 1 suggests considering a partition of the set of possible initial contracts according to whether they prevent or not the replacement of the incumbent when $(p; q) = (p_H; q_L)$: Our next result provides a particularization of the incentive compatibility condition within each of these sets.

Proposition 2 With an independent board, if the severance pay induces the replacement of the incumbent at $(p_H; q_L)$; that is $s < (q_L - p_H)R$; then the incentive compat-

ibility condition holds if and only if

$$\Delta_0 \cdot w \geq B: \tag{4}$$

Otherwise, incentive compatibility requires at least

$$\Delta_0 \cdot w + \Delta_L[C - (q_L - p_H)R] \geq B; \tag{5}$$

which is sufficient in the polar case where $s = (q_L - p_H)R$:

This result has two substantial implications. First, setting a strictly positive severance pay can be good for incentives. In particular, by comparing (4) and (5), one can notice that with the severance pay $s = (q_L - p_H)R$ rather than zero the incumbent's expected return from choosing p_H increases by $\Delta_L[C - (q_L - p_H)R]$; which is the expected net surplus (including control rents) associated with retaining him when a rival of type q_L becomes available. In terms of the incentive compatibility condition, this reward reduces the size of the minimum bonus w required to induce him to invest.

Second, setting a severance pay in excess of $s = (q_L - p_H)R$ is not good for incentives, rather the opposite. It does not modify the replacement policy, but increases the income that the manager can get by choosing p_L and waiting for either the generous s or the renegotiated severance pay $p_L w + (q - p_L)R$ that he will receive if a better manager is discovered. To offset this effect shareholders would have to increase w: So both in terms of incentives and compensation costs, setting s above $(q_L - p_H)R$ does not have any advantage. We will formally confirm this below.

3.3 The optimal initial contract

Shareholders will select the incentive compatible contract $(w; s)$ that maximizes the value of the firm to them, namely, the expected terminal cash flow of the project net of the expected cost of compensating the manager: $V = E_q[[(1 - r)p + rq]R - W]$

p_H]. The selection is to be made among the cheapest incentive compatible contracts of the two sets mentioned above. The ¯nal choice depends upon the comparison of

$$V_I^{\alpha} = AR - \frac{p_H}{\phi} B + \mu_L (q_L - p_H) R; \tag{6}$$

and

$$V_I^{\alpha\alpha} = AR - \frac{p_H}{\phi} [B - \mu_L [C - (q_L - p_H) R]] - \mu_H (q_L - p_H) R; \tag{7}$$

where $A = (\mu_0 + \mu_L) p_H + \mu_H q_H$. The result is as follows:

Proposition 3 Suppose that corporate governance relies on an independent board of directors. If $V_I^{\alpha} = V_I^{\alpha\alpha}$, the optimal compensation contract is $(w_I^{\alpha}; s_I^{\alpha})$, where

$$w_I^{\alpha} = \frac{B}{\mu_0 \phi} \tag{8}$$

and $s_I^{\alpha} = 0$, so that the incumbent is replaced whenever a rival manager $q = q_L; q_H$ becomes available. Otherwise, it is $(w_I^{\alpha\alpha}; s_I^{\alpha\alpha})$, where

$$w_I^{\alpha\alpha} = \frac{B - \mu_L [C - (q_L - p_H) R]}{\mu_0 \phi} < w_I^{\alpha} \tag{9}$$

and $s_I^{\alpha\alpha} = (q_L - p_H) R$; so the incumbent is replaced if $q = q_H$ but not if $q = q_L$:

This result clari¯es the role of golden parachutes in ¯rms governed by an independent board of directors: they may be used to substitute for performance-based compensation. Golden parachutes can be set so as to induce a replacement policy that makes control rents play a role in rewarding the incumbent CEO for his investment decision. This allows shareholders to save on more explicit pecuniary compensation {compare the second terms in the RHS of equations (6) and (7). However, golden parachutes have two negative e®ects. First, they preclude modest managerial improvements such as q_L {whose value appears in the third term in (6). Second, they rise the cost of introducing major managerial improvements such as q_H {hence the third term in (7). By simply comparing V_I^{α} and $V_I^{\alpha\alpha}$, we could identify the factors

that determine when the saving on performance-related compensation exceeds these two costs. We relegate, however, this discussion to Section 5, where we examine the alternative corporate governance structures as a whole and elaborate on the empirical implications of our results.

To conclude the section, we must check that shareholders do indeed want to implement p_H rather than p_L: Notice that in order to implement p_L the shareholders would optimally set $w = s = 0$ and will replace the manager whenever a rival shows up. In this case the value of the ¯rm would be

$$\overline{V}_I = (\mu_0 p_L + \mu_L q_L + \mu_H q_H)R:$$

Hence we need that $\overline{V}_I < \max\{V_I^{¤}; V_I^{¤¤}\}$. A su±cient condition is

$$\mu_0 ¢ R > \frac{p_H}{¢} B: \tag{10}$$

which implies $\overline{V}_I < V_I^{¤}$.

4 The CEO-controlled Board

This section considers the functioning of corporate governance and the design of CEO compensation when the incumbent CEO can veto his own replacement. We associate this situation with the operation of a board of directors in which the CEO has the support of a majority of loyal directors who are willing to block his dismissal, unless it happens under his consent.[7]

The allocation of veto power to the CEO eliminates the possibility that his control rents are unwantedly "expropriated" by the shareholders. With an independent board

[7]Limiting the incumbent's "control" of the board to his own replacement excludes alternative allocations of control that would turn out to be suboptimal. For instance, the obvious extreme in which the CEO controls his own compensation package: in reality most corporations prevent this by delegating authority on compensation to a compensation committee comprised of independent directors only.

the severance pay s was used as a credible commitment to limit such expropriation, and it was valuable in that it allowed shareholders to use part of C as a reward for effectiveness. The same logic does not apply here. Now the CEO can preserve his control rents (or renegotiate before giving them up) no matter the effectiveness of his management. This may cast doubts on the potential optimality of this arrangement {which might easily induce too much entrenchment{ as well as lead to the conclusion that severance pay has no role to play with a CEO-controlled board.

Both conclusions are too precipitate. In a CEO-controlled board savings on performance-based compensation can occur if the payoff of the incumbent in the renegotiation leading to his replacement (when q_H realizes) increases with the effectiveness of his management. This can be achieved by setting a severance pay such that, if he chooses p_L rather than p_H and shareholders propose him to leave the firm, he will step down without further renegotiation, whereas if he chooses p_H he can credibly threaten shareholders to keep running the firm unless they give him part (or all) of the replacement surplus. Ex ante, this surplus will be seen by the CEO as a direct reward to p_H, allowing shareholders to save on performance based compensation.

In order to characterize the optimal arrangement formally, we proceed like in the previous section. We first look at the renegotiation stage to describe the replacement outcome associated with a given contract $(w; s)$ under each possible choice of p and realization of q. After that, we study how the CEO's incentives to invest to improve the effectiveness of his organization depend on the contract. Finally, we compute the value of the firm to its shareholders as a function of the contract variables and determine which contract is the best.

4.1 Renegotiation and the replacement decision

Consider a given contract $(w; s)$ at the stage where p has already been chosen and a rival manager $q = q_L; q_H$ has been discovered. A replacement decision r has to

be made, possibly after renegotiating the relevant compensation of the incumbent manager. The incumbent and the shareholders meet at the board of directors knowing that in the absence of an agreement, the decision $r = 1$ cannot be made without the consent of the incumbent.

As before, we denote the (hypothetical) replacement decision in case of no agreement by d. Given that the incumbent CEO has veto power on this own replacement, this will only occur if, under the initial contract, both him and the shareholders find it convenient that he steps down. On shareholders side this requires:

$$s < pw + (q - p)R \tag{11}$$

while on the incumbent's side this requires

$$s > pw + C: \tag{12}$$

So we will have $d = 1$ if and only if $(q - p)R > C$ and $s \in (pw + (q - p)R; pw + C)$. As before, however, the final decision on r will differ from d if changing it can benefit both parties. The outcome of the renegotiations is summarized in the following proposition.

Proposition 4 With a CEO-controlled board, the renegotiations about the replacement of the incumbent CEO under an initial contract $(w; s)$ and a given pair $(p; q)$ will yield the following outcome:

1. When $(q - p)R > C$; the replacement decision is $r = 1$ and the expected pecuniary compensation of the CEO is
$$W = \begin{cases} pw + (q - p)R; & \text{if } s \leq pw + C; \\ s; & \text{if } s > pw + C: \end{cases}$$
2. When $(q - p)R \leq C$; the replacement decision is $r = 0$ and $W = pw$.

Importantly, the final replacement decision now only depends on whether the cash flow gains from replacing the manager $(q - p)R$ exceed or not the control rent C. This

con¯rms that, in contrast to the case of an independent board, the severance pay s does not a®ect the replacement policy. Nevertheless, s is far form irrelevant to the problem since it a®ects W through its impact on the renegotiation that follows the discovery of a rival manager.

Notice that when $(q - p)R > C$ the expression for W exhibits a discontinuity at $s = pw + C$; that is, the severance pay below which the incumbent can credibly threaten the shareholders to stay in charge of the ¯rm. Therefore, for given w and $(q - p)R > C$, the in¯mum of W is approached as s approaches $pw + C > 0$ from above. This ¯nding suggests an interesting role for severance pay in ¯rms governed by CEO-controlled boards. Clearly, $s > pw + C$ renders the incumbent's threat not to leave non credible once he has chosen p, which limits his advantage when bargaining on his replacement with the shareholders. This feature can be used to make the rents appropriated by the CEO in the renegotiations on replacement an increasing function of p, o®ering an alternative to performance based compensation.

Finally, as in the case of an independent board, when no rival manager becomes available, $(q = 0)$, no replacement takes place and $W = pw$; as stipulated in the initial contract.

4.2 CEO incentives and the initial contract

When deciding on the investment necessary to improve the e®ectiveness of his organization, the incumbent CEO evaluates whether doing so increases his expected pecuniary and non pecuniary income in excess of the private cost B. Since the replacement policy is now independent of the initial contract, we can separate the contract-sensitive pecuniary part of the incremental income from the contract-insensitive non-pecuniary one. Moreover, since the choice of p a®ects the latter simply because $(p_L; q_L)$ leads to $r = 1$ whereas $(p_H; q_L)$ leads to $r = 0$; the incentive compatibility

condition for p_H reduces to

$$E_q[W|\, p_H] - E_q[W|\, p_L] \geq B - \mu_L C. \tag{13}$$

In words, the incumbent CEO will invest in increasing the quality of his management if this rises his pecuniary income in excess of the net non-pecuniary cost $B - \mu_L C$ of the investment. The term $-\mu_L C$ reflects that the CEO internalizes that choosing p_H allows him to preserve C when a rival of type q_L becomes available.

4.3 The optimal initial contract

Shareholders will select the incentive compatible contract $(w; s)$ that maximizes the expected terminal cash flow of the project net of the expected cost of compensating the manager. Since the replacement decision does not depend on the compensation contract, the objective function can be written as

$$V = AR - E_q[W|\, p_H];$$

where $A \doteq \mu_0 p_H + \mu_L p_H + \mu_H q_H$; like in the previous section. Hence shareholders will simply choose the incentive compatible contract that entails the lowest expected pecuniary compensation to the CEO.

Proposition 5 describes the optimal contract under the technical assumption

$$B > \mu_H[(q_H - p_H)R - C]; \tag{14}$$

which allows us to avoid the discussion of uninteresting corner solutions to the contract problem {in particular, those in which the bonus w may turn out to be zero.

Proposition 5 Suppose that corporate governance relies on a board of directors controlled by the CEO. Then the optimal compensation contract is $(w_D^{\alpha}; s_D^{\alpha})$; where

$$w_D^{\alpha} = \frac{B - \mu_H[(q_H - p_H)R - C]}{\phi} \tag{15}$$

and $s_D^{\alpha} = p_L w_D^{\alpha} + C$, and the incumbent is replaced if $q = q_H$ but not if $q = q_L$.

The optimal severance pay s_D^{α} makes some of the renegotiations that transfer income to the CEO occur only if he chooses p_H, which increases $E_q[W|p_H]$ relative to $E_q[W|p_L]$. This allows reductions in the bonus w and overall savings on managerial compensation. Speci¯cally, under the optimal contract choosing p_H rather than p_L gives to the incumbent CEO an extra cash °ow of $(q_H - p_H)R - C$ from renegotiating about his dismissal when q_H occurs. This explains why the optimal bonus w_D^{α} is a decreasing function of the corresponding expected renegotiation surplus, $\mu_H[(q_H - p_H)R - C]$.

An interesting property of the optimal compensation contract is that the golden parachute s_D^{α} and the bonus w_D^{α} tend to move together. In particular, the factors that increase w_D^{α} increase s_D^{α} as well. Thus, contrarily to the case of an independent board, severance payments seem to complement (rather than substitute) performance-based compensation. This provides a testable implication that will be further discussed in the next section.

To conclude this section, we check that, conditional on the use of a CEO-controlled board, shareholders do indeed want the incumbent manager to choose p_H. Under the optimal contract derived in Proposition 5, the value of the ¯rm equals:

$$V_D^{\alpha} = AR - \frac{p_H}{\rho}[B - \mu_H[(q_H - p_H)R - C]] - \mu_H(q_H - p_H)R: \qquad (16)$$

In contrast, in order to implement p_L; the shareholders would just set $w = 0$ and $s = C$; in which case the value of the ¯rm would be

$$\overline{V}_D = (\mu_0 p_L + \mu_L q_L + \mu_H q_H)R - (\mu_L + \mu_H)C:$$

Hence the optimality of p_H requires $\overline{V}_D < V_D^{\alpha}$: As in the case of independent boards, condition (10) su±ces to guarantee the desirability of p_H.

5 Optimal Board Design: Determinants and Implications

The analysis in previous sections identi¯es three potentially optimal corporate governance structures. Two of them, which will be denoted by $I^{¤}$ and $I^{¤¤}$, involve an independent board and the compensation contracts $(w_I^{¤}; s_I^{¤})$ and $(w_I^{¤¤}; s_I^{¤¤})$; respectively. The other, which will be denoted by $D^{¤}$, involves a CEO-controlled board and the compensation contract $(w_D^{¤}; s_D^{¤})$. In this section we prove that each of them may emerge as an optimal corporate governance structure, examine the factors that determine their optimality, and discuss the empirical implications of the analysis.

5.1 Three potentially optimal structures

We start by showing, with three examples, that any of these structures can be optimal. We ¯x all parameters except C at the values R = 100; B = 5; p_L = 0:5; p_H = 0:75; q_L = 0:81; q_H = 0:99; $¼_L$ = 1=6; $¼_H$ = 1=6; and compute the contracts and ¯rm value under three di®erent levels of control rents: 9, 15, and 21:[8] The results are reported in Table 1, where the rows corresponding to the optimal structure appear in bold face.

Table 1. Three examples

	C = 9			C = 15			C = 21		
	w	s	V	w	s	V	w	s	V
$I^{¤}$	30	0	65:0	30	0	65:0	30	0	65:0
$I^{¤¤}$	27	6	61:5	21	6	64:5	15	6	67:5
$D^{¤}$	10	14	67:5	14	22	64:5	18	30	61:5

The general comparison of the three structures in terms of pay-for-performance

[8] These parameter values satisfy the assumptions made in equations (1), (10), and (14).

sensitivity (w), golden parachutes (s), and turnover frequency (the equilibrium probability of r = 1) is summarized in Table 2. The results directly come from comparing the expressions for w and s and the replacement policies characterized in Propositions 3 and 5.[9]

Table 2. Di®erences across governance structures

	I^{α}	$I^{\alpha\alpha}$	D^{α}
Pay-performance sensitivity	high	medium	low
Golden parachute	none	medium	high
Turnover frequency	high	low	low

Accordingly, severance pay is more likely to be used and will be larger in CEO-controlled boards than in independent boards, while the sensitivities of pay to performance will tend to be lower in the former than in the latter. Structure I^{α} appears clearly as the structure closest to the \ideal" governance system espoused in the literature, while D^{α} seems to ¯t the stylized description of a governance system a®ected by \entrenchment" and $I^{\alpha\alpha}$ combines elements of both of them.

5.2 Factors that determine the optimality of each structure

To further explore the determinants of the optimal structure, we can use expressions (6), (7), and (16) to de¯ne the frontiers of the regions of the parameter space where each structure dominates. Figure 2 represents these frontiers in two relevant dimensions: p_L; which is a measure of the severity of the managerial incentive problem, and

[9] To assess the pay-for-performance sensitivity under $I^{\alpha\alpha}$ and D^{α}; we evaluate w_I^{α} and w_D^{α} at the indi®erence frontier where $V_I^{\alpha\alpha} = V_D^{\alpha}$. It is immediate to check that this condition implies $w_I^{\alpha} > w_D^{\alpha}$. This is also true whenever $V_I^{\alpha\alpha} < V_D^{\alpha}$: When $V_I^{\alpha\alpha} > V_D^{\alpha}$; there may be cases where the inequality gets reversed (e.g., in the third panel in Table 1).

C, which is a measure of the importance of the time inconsistency and entrenchment problems associated with managerial control rents.[10]

Figure 2 depicts the rectangle where $p_L \in [0; p_H]$ and $C \in [(q_L - p_H)R; (q_H - p_H)R]$. This rectangle is divided by the straight lines L_1; L_2, and L_3; that are de¯ned by the indi®erence conditions $V_I^{\star} = V_I^{\star\star}$; $V_I^{\star} = V_D^{\star}$; and $V_I^{\star\star} = V_D^{\star}$; respectively. Their properties are apparent in the diagram: They pass through the points P_1; P_2, and P_3; respectively, intersect at a single point in the interior of the rectangle, and have the relative slopes indicated in the ¯gure; in particular, L_2 has a slope greater than that of L_3. In the end, the parameter space splits in three regions which identify when each of our candidate governance structures is optimal.[11]

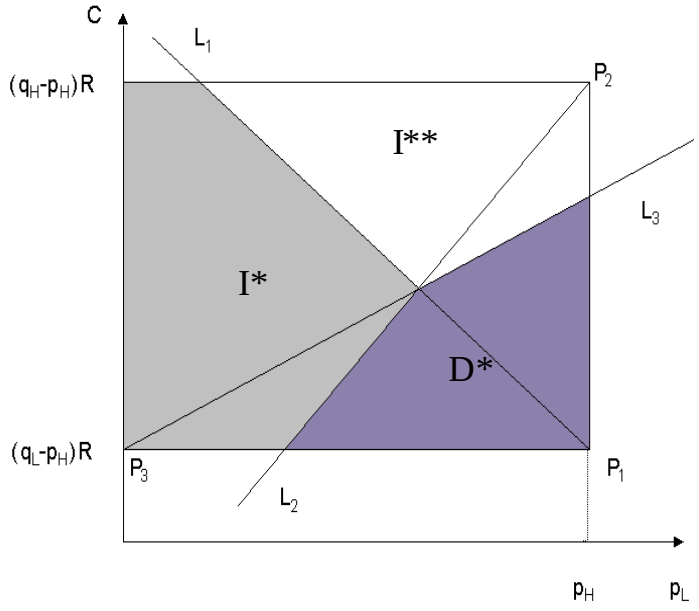

Figure 2. Optimal structures

[10]Notice that, for given p_H, an increase in p_L reduces ¢, which is a key determinant of the size of w: Intuitively, as ¢ decreases, performance becomes \noisier" as a signal of managerial e®ectiveness, increasing the cost of providing incentives through performance-based compensation.

[11]Further details about the derivation of Figure 2 are included in the proof of Proposition 6.

According to the figure, the "ideal" governance structure, I^{α}, works well if incentive compensation is highly effective (p_L is low) or if the control rents are neither high enough to recommend $I^{\alpha\alpha}$ nor low enough to recommend D^{α}. The independent board with golden parachutes, $I^{\alpha\alpha}$, is the solution when pay-for-performance is very costly and control rents are large, since in this case solving the time inconsistency problem in managerial replacement has a big return in terms of savings in performance-based compensation. Finally, the CEO-controlled board, D^{α}, is optimal when pay-for-performance is again very costly, but control rents are small. Small control rents allow shareholders to reward the effectiveness of the incumbent CEO with power to bargain on his own dismissal, but without having to pay much for preventing the entrenchment temptations that, given C; he may have even if he is not effective.[12] Summing up, the noisier the link between managerial actions and performance measures, the less efficient performance-based compensation becomes.

Both $I^{\alpha\alpha}$ and D^{α} use the replacement policy to substitute for performance-based compensation, but they do it in a very different manner. In $I^{\alpha\alpha}$ the reward to managerial effectiveness partly comes from making the CEO to preserve C when modestly better managers become available. In contrast, in D^{α} the rewards to effort relate to how the CEO bargains on the terms of his own dismissal when a significantly better manager is discovered. This explains the following result:

Proposition 6 In a sample of firms that differ in p_L and C, an improvement in the prospects of external managerial innovation (the ratio μ_H/μ_L) will increase the number of CEO-controlled boards and decrease the number of independent boards with golden parachutes.

This and other predictions coming from previous results are discussed in the next subsection.

[12] Note that the severance pay s_D^{α} required to avoid entrenchment if p_L is chosen increases one-by-one with C:

5.3 Discussion of the empirical implications

We can separate the empirical implications of the analysis in three distinct sets. The first refers to the cross-sectional variation in the nature of corporate boards of directors. The second refers to the use of performance-based compensation. The final one contains the predicted relationships among the different (endogenous) instruments of governance considered so far.

Our model identifies managerial control rents as an important determinant of the structure of the board. Hermalin and Weisbach (1988) report that CEO tenure, a proxy for the size of these rents, is positively related to the probability of nomination of insiders as directors. If the present value of control rents is larger for younger or more recently designated CEOs, our model predicts that their control of the board should indeed be less prevalent. Proposition 6 also predicts a larger incidence of CEO-controlled boards (vis-a-vis independent boards with golden parachutes) in industries and periods of time with larger managerial turmoil (e.g., after a major regulatory, technical or organizational change). If shareholders expect to face more profitable opportunities of replacing the incumbent CEO in the future, they will tend to offer him greater \protection" in the form of entrenchment as a means of saving on alternative pay-for-performance compensation.[13]

Our analysis also has implications on the use of pay-for-performance compensation. After the influential study by Jensen and Murphy (1990), which advocated increasing performance sensitivity in top management compensation, there has been a noticeable growth in the use of incentive compensation {see, for instance, Murphy

[13]Notice that such a move towards CEO-controlled boards may be accompanied by an increase in managerial turnover. Increasing $\frac{1}{4}_H$ relative to $\frac{1}{4}_L$ expands the D^{α} region and contracts the $I^{\alpha\alpha}$ region, while the effect on the I^{α} region is ambiguous. If the increase in $\frac{1}{4}_H$ relative to $\frac{1}{4}_L$ does not reduce $\frac{1}{4}_L + \frac{1}{4}_H$ and does not significantly decrease the number of firms using I^{α}; then the increase in $\frac{1}{4}_H$ will indeed lead to greater turnover.

(1999){ perhaps also encouraged by the enactment of new regulations.[14] In reaction to this tendency, our analysis suggests complementary changes in other elements of the governance system. Suppose that, e.g. due to technological progress, pay-for-performance compensation becomes more e®ective (in terms of Figure 2, p_L falls). Then, across ¯rms with independent boards, the move towards greater performance sensitivity may allow savings on severance pay and an increase in turnover (that is, a full move from I¤¤ to I¤). However, across ¯rms with a CEO-controlled board, the change might increase the entrenchment tendencies of managers and hence call for either an increase in severance pay or a shift towards greater board independence (that is, a full move from D¤ to I¤).

The previous argument relates to another implication of our analysis: that severance pay and performance-based compensation complement each other (that is, move in the same direction in response to parameter changes) in CEO-controlled boards, while they may substitute each other (sometimes move in opposite directions in response to those changes) in independent boards. The result is formally stated for the case in which the varying parameter is C.

Proposition 7 Consider a sample of ¯rms that di®er in C. Then, performance-based compensation (i.e., w) and severance pay (i.e., s) will be negatively correlated across ¯rms with an independent board, while they will be positively correlated across ¯rms with a CEO-controlled board.

The empirical linkages between managerial compensation and boards have not been carefully examined. A ¯rst step is given by Core, Holthausen, and Larcker (1999) who report that CEOs earn greater total compensation when governance structures are less e®ective and that increasing the percentage of inside directors in the board

[14] New Compensation Disclosure Rules have been required by the SEC and the Internal Revenue Code has introduced limits to the tax deductibility of any non-performance-related pay in excess of one million dollars. See Perry and Zenner (1997) for details.

reduces all measures of CEO compensation, as well as the ratio of variable to total compensation. While this last reported fact seems in line with our predictions, more empirical work in this area is required before we can make a fair assessment of the empirical validity of the results presented here.

We should conclude this section with a note of caution. We have o®ered an integrated analysis of CEO compensation and boards as mechanisms of corporate governance. In the next section we further extend the picture by considering takeovers. Yet, to keep things tractable, we have ignored the role of ¯nancial mechanisms, i.e., leverage and bankruptcy.[15] Our work is thus complementary to Berkovitch, Israel, and Spiegel (1998), where the interactions between CEO compensation and capital structure are examined in detail. In particular they identify circumstances in which issuing risky debt makes the replacement policy more aggressive, while the use of golden parachutes, like in our independent board, makes it less aggressive. They also o®er a rich set of predictions related to the e®ects of replacement decisions and changes in managerial compensation on ¯rm value and the impact of leverage on compensation and turnover. Until a comprehensive model in which CEO compensation interacts with both governance and capital structure is developed, the empirical work should consider both sets of predictions, theirs and ours, as non mutually exclusive.[16] If anything, identifying potential interactions between governance and capital structure in the data would provide a useful guidance for future theoretical work.

[15] In particular, we have adopted a distribution of terminal cash °ow under which the distinction between debt and equity is irrelevant.

[16] There is, however, one exception. Berkovitch et al. (1998) predict a fall in value after CEO replacement whereas our model predicts that ¯rm value would raise.

6 The Takeover Mechanism

Until now we have analyzed di®erent corporate governance structures in the absence of takeovers. We now introduce takeovers threats, i.e., the possibility that an insurgent shareholder (or group of shareholders) might act to alter the composition of the board and change the decision on CEO replacement, and examine how such threats can a®ect the optimal governance structures derived above. For brevity, instead of performing a complete analysis of the extended model, we will focus on two major and contrasting insights. First, on the possibility that, by impeding ex-post transfers of surplus to the CEO after a major improvement such as q_H, "excessive" takeover pressure may eliminate, de facto, our previous rationale for CEO-controlled boards. Second, on how "moderate" takeovers threats can complement CEO-controlled boards at implementing a "soft" replacement policy like that in I°° but without costly severance pay or costly renegotiations prior to the replacement of the incumbent.

6.1 A simple model of takeovers

We consider the possibility that a takeover can occur after the uncertainty on the availability of a rival manager is resolved but before the board of directors has decided on replacement. In a set-up similar to Grossman and Hart (1980), we assume the existence of a large shareholder with a fraction ® of the ¯rm who, to control the board, needs to organize a costly takeover bid. The administrative costs of the bid are Á > 0. We assume that the remaining shareholders consider themselves non-pivotal for the success or failure of the takeover and that the pair $(p; q)$ is public information at the time of the bid. If the bid succeeds, the bidder gets control of the board and the decisions (and renegotiations) on replacement take place as in our previous independent-board case.

The minimum price at which shareholders will tender their shares in a successful

bid equals the value that those shares are expected to reach under the resulting new board of directors. Therefore the bidder only bene¯ts from the transaction through the increase in the value of her pre-existing shares. Anticipating this, the tender o®er will occur if:

$$\mathbb{R}G > Á, \tag{17}$$

where G represents the gains to shareholders (incremental cash °ow net of payments to the incumbent CEO) induced by the change in the control of the board.[17]

An implication of (17) is that takeovers would not occur if the board of directors is originally independent: the bidder's control of the board is allocationally identical to shareholders' control, so we have G = 0 in that case. Hence the arrangements previously denoted by $I^{¤}$ and $I^{¤¤}$ continue to be potentially optimal corporate governance structures in the world with takeovers. In this set-up, the possibility of takeovers does not change anything in corporations whose boards are independent and thereby aligned with shareholders' interest at all times.

6.2 Takeovers and CEO-controlled boards

In contrast to the case of an independent board, in a CEO-controlled board takeover threats can have important consequences. If a rival manager is discovered one or several shareholders might be tempted to organize a takeover bid to gain full control of the board. In particular they may want to intervene to implement a managerial improvement that would be ignored by the CEO-controlled board or, simply, to make shareholders obtain more surplus in the renegotiations on replacement. Consequently in the presence of takeover threats, incentives and optimal managerial compensation under an initially CEO-controlled board change quite a bit relative to our discussion in Section 4.

[17] Absent dilution, the free-rider problem among shareholders makes toeholds ($\mathbb{R} > 0$) essential for the pro¯tability of takeover bids (see Shleifer and Vishny (1986)).

The possibility of takeovers can produce two major e®ects on the optimal governance structures derived before. First, strong takeover threats, arising from either large toeholds ® and/or small administrative costs Á, would eliminate the bene¯t of yielding control of the board to the CEO. A governance structure like D¤ is no longer e®ective if the renegotiation on replacement following the incumbent's resistance to step down is undermined by the success of a hostile bid that introduces a new, shareholder oriented, board. Governance will then be forced to be carried through with structures that work, de facto, such as I¤ and I¤¤. Hence if D¤ was optimal without takeover threats, their presence will cause a loss of value to shareholders.[18]

A second e®ect occurs in the presence of less stringent takeover threats. In some circumstances a combination of a CEO-controlled board with the takeover mechanism will dominate any of the independent board arrangements. Such a combination may implement the same selective replacement rule that characterizes I¤¤ and the old D¤ but with important advantages. First, relative to I¤¤, it may not be necessary to rely on severance pay to deter shareholders from excessive intervention, since the constraint on shareholder activism imposed by (17) may su±ce. Second, relative to D¤, replacing the manager in $(p_H; q_H)$ will be cheaper to shareholders, since the takeover organized at that point will transform the opposing CEO-controlled board into an independent board.

To illustrate this possibility in a simple way, we will consider the case in which $p_L = 0$ what suppresses our previous rationale for CEO-controlled boards[19] and restrict attention to CEO-controlled boards accompanied by initial compensation schemes

[18] This e®ect is related to Stein (1991) who shows that protecting managers from excessive takeover pressure may improve their incentives to undertake long-term investments.

[19] With $p_L = 0$ the use of performance-based compensation does not generate any extra managerial rent because success occurs with positive probability only if the incumbent chooses p_H. Compare (6) with (16) to check that, if $p_L = 0$, D¤ is strictly dominated by I¤.

with $s = 0$:[20]

Proposition 8 Denote by G_{ij} shareholders' gains from transforming a CEO-controlled board into an independent board in state $(p_i; q_j)$: Then,

$$G_{LH} \geq G_{HH} \geq G_{HL} \quad \text{and} \quad G_{LH} \geq G_{LL} \geq G_{HL}: \tag{18}$$

This proposition implies that the state in which a takeover is most likely to occur is $(p_L; q_H)$ and that in which it is least likely to occur is $(p_H; q_L)$. As mentioned before, for low values of $\frac{Á}{®}$ a CEO-controlled board will work, de facto as an independent one and, in contrast, for high values of $\frac{Á}{®}$ takeovers will not be pro¯table in any state and the board will remain under CEO control. However an interesting situation arises for intermediate values of $\frac{Á}{®}$; for which a takeover occurs and implements $r = 1$ in state $(p_L; q_L)$ but not in state $(p_H; q_L)$:

The following result shows that there are circumstances in which such a governance structure dominates the structures based on an independent board.

Proposition 9 Suppose that $B \geq \frac{1}{4}_L C + \frac{1}{4}_H (q_H - p_H)R$ and

$$´ < \frac{Á}{®} < q_L R; \tag{19}$$

where $´ \equiv \min\{(q_L - p_H)R + \frac{B - \frac{1}{4}_L C}{1 - \frac{1}{4}_H}; (1 - \frac{1}{4}_H)(q_H - p_H)R + (B - \frac{1}{4}_L C)\}$. Then, there is a governance structure with a CEO-controlled board and $s = 0$ that dominates the independent board structures $I^{¤}$ and $I^{¤¤}$:

The main implication of the analysis is that the optimal type of board may depend on the existence and intensity of takeover threats. While stringent takeover threats would make inconsequential any ex-ante transfer of control to the CEO, in the presence of moderate takeover activity shareholders may actually pro¯t from a move towards more CEO control. More generally, di®erences in takeover activity over

[20] Under the conditions of Proposition 9 below this is without loss of generality.

time or across countries (perhaps related to ¯nancial institutions or the availability of ¯nance) may explain the variation in other aspects of corporate governance such as board independence and the size of severance pay. Finally, we should notice that, although the cost of takeovers has been taken as exogenous in the analysis, condition (19) suggests that ¯ne-tuning the parameters related to the aggressiveness of the potential bidders may have value. For instance, anti-takeover amendments might be useful in order to guarantee that takeover intervention is selective. In contrast, if the incumbent CEO can adopt takeover defenses that make takeovers excessively costly, a positive severance pay might conveniently reduce his incentive to resist.

7 Concluding Remarks

The analysis in this paper describes the advantages and disadvantages of protecting managerial control rents and yielding to the incumbent CEO some control of the decisions that a®ect these rents. The analysis focuses on the managerial replacement decisions of the board of directors. Transferring control of the board of directors to the CEO can reduce the need for incentive compensation, with the corresponding saving for shareholders. However transferring control to the CEO promotes managerial entrenchment and hence requires the use of other elements of compensation (speci¯cally, severance pay) to adjust the incentives of the CEO to opportunistically obstruct his own replacement.

The trade-o® between explicit managerial compensation and compensation in terms of control rents and control rights o®ers novel insights on the rationale for certain corporate governance structures. For example, it implies that an optimal corporate governance structure may exhibit some of the usual features of managerial entrenchment: low pay-performance sensitivity, high severance pay, and low managerial turnover. So these features may re°ect a second-best response to the underlying incentive problem.

Our analysis of the linkages between managerial compensation and board structure suggests several directions for empirical research. We predict that severance pay is more likely to be used and will be larger in CEO-controlled boards than in independent boards, and that the sensitivities of pay to performance are lower in the former than in the latter. Our results also imply that severance pay substitutes for performance-based compensation in independent boards (where both components typically move in opposite directions in response to some parameter changes), while both complement each other (that is, move together) in CEO-controlled boards. Finally, our predictions suggest relating corporate governance structures to industry-speci¯c factors (such as the prospects of external managerial innovation), CEO-speci¯c factors (such as his age and the speci¯city of his human capital), the e®ectiveness performance-based compensation (i.e., the precision of performance as a signal of managerial input), and the level of takeover activity.

On the theoretical side, there is also interesting work ahead. We have o®ered an integrated analysis of CEO compensation, boards, and takeovers but we have ignored the role of ¯nancial mechanisms, i.e., leverage and bankruptcy. Providing a more general yet tractable model in which CEO compensation interacts with both governance and capital structure is a challenge left for future research.

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APPENDIX

Proof of Proposition 1 Suppose first that (2) holds so $d = 0$: In this case the renegotiation will consist in finding an alternative severance pay $s' \geq 0$ (expectably lower than s) such that both parties end up (weakly) better off setting $r = 1$ and enforcing s' rather that s. Given the status-quo payoffs associated with $d = 0$ under the initial contract, the proposal s' will be acceptable to the shareholders if it verifies $qR - s' \geq p(R - w)$; while it will be acceptable to the CEO if it verifies $s' \geq pw + C$. The compatibility of these two inequalities requires that there exists s' such that

$$pw + (q - p)R \geq s' \geq pw + C.$$

Thus if

$$(q - p)R \geq C; \tag{20}$$

the renegotiation will lead to $r = 1$: In particular, according to the assumed renegotiation procedure, the incumbent CEO will make a take-it-or-leave-offer $s' = pw + (q - p)R$ to the shareholders, leaving them at their status-quo level of utility. The pecuniary compensation of the CEO will then be

$$W = pw + (q - p)R.$$

In contrast, if condition (20) fails, the final replacement decision will be $r = d = 0$; and the expected pecuniary compensation of the CEO will be

$$W = pw;$$

as stipulated in the initial contract.

Suppose next that condition (2) does not hold so $d = 1$: In this case the renegotiation will consist in specifying an alternative salary $w' \geq 0$ (expectably lower than w) for the incumbent CEO such that both parties end up (weakly) better off setting $r = 0$ and enforcing w' rather than w. Given the status-quo payoffs associated with $d = 1$

under the initial contract, a mutually acceptable w^0 should satisfy $p(R - w^0) \geq qR - s$ on the shareholders' side, and $pw^0 + C \geq s$ on the CEO side. These two inequalities imply

$$(q - p)R \leq s - pw^0 \leq C:$$

Hence, a mutually bene¯cial renegotiation requires both

$$(q - p)R \leq C; \tag{21}$$

and, by the non-negativity of w^0,

$$s \geq (q - p)R: \tag{22}$$

Thus, if conditions (21) and (22) are satis¯ed, the renegotiation will lead to $r = 0$: In particular, according to the assumed renegotiation procedure, the incumbent CEO will make a take-it-or-leave-o®er $pw^0 = s - (q - p)R$ to the shareholders, leaving them at their status-quo level of utility. The expected pecuniary compensation of the CEO will then be

$$W = s - (q - p)R:$$

In contrast, if either (21) or (22) fail, the ¯nal replacement decision will be $r = d = 1$; and the pecuniary compensation of the CEO will be

$$W = s;$$

as stipulated in the initial contract. After some reordering of the relevant conditions, we get the results stated in the proposition.[21] ¥

Proof of Proposition 2 Using Proposition 1 (together with prior observations about the case $q = 0$) we can obtain an explicit expression for the manager's expected

[21] In cases of indi®erence about the ¯nal replacement decision, we break the tie w.l.o.g. by assuming that the incumbent CEO keeps his job.

income when he does not invest:

$$E_q[W + (1 - r)C \mid p_L] = \mu_0(p_L w + C) + \mu_L \min\{p_L w + (q_L - p_L)R;\ s\} + \mu_H \min\{p_L w + (q_H - p_L)R;\ s\}. \quad (23)$$

This expression reflects that the incumbent keeps his job only in case no rival manager becomes available. When a rival manager appears, the incumbent receives either the initially contracted severance pay s; if it is not too high, or, otherwise, a new one fixed through renegotiation .

For the case the manager invests, our discussion following Proposition 1 suggests considering two separate cases. Suppose first that $s < (q_L - p_H)R$: Then

$$E_q[W + (1 - r)C \mid p_H] = \mu_0(p_H w + C) + \mu_L s + \mu_H \min\{p_H w + (q_H - p_H)R;\ s\};$$

where the last two terms are obtained from Proposition 1 noting that $(q_L - p_H)R < C$ and $(q_H - p_H)R > C$; respectively. Moreover, since $p_H w + (q_H - p_H)R > (q_L - p_H)R > s$; the last term simplifies to $\mu_H s$. So we have

$$E_q[W + (1 - r)C \mid p_H] = \mu_0(p_H w + C) + \mu_L s + \mu_H s.$$

For similar reasons, the last two terms in (23) also simplify to $\mu_L s$ and $\mu_H s$; respectively. Thus the incentive compatibility condition (3) reduces to:

$$\mu_0 \phi w \geq B.$$

Suppose next that $s \geq (q_L - p_H)R$: Then if $p = p_H$; the incumbent will keep his job both when $q = 0$ and when $q = q_L$; so we have

$$E_q[W + (1 - r)C \mid p_H] = \mu_0(p_H w + C) + \mu_L[\min\{p_H w; s - (q_L - p_H)R\} + C] + \mu_H \min\{p_H w + (q_H - p_H)R; s\};$$

which, in order to facilitate the comparison with (23), can be reordered as follows:

$$E_q[W + (1 - r)C \mid p_H] = \mu_0(p_H w + C) + \mu_L \min\{p_H w + (q_L - p_H)R; s\} + \mu_H \min\{p_H w + (q_H - p_H)R; s\} + \mu_L[C - (q_L - p_H)R] \quad (24)$$

Interestingly, the severance pay s only a®ects the second and third terms in (23) and (24). Comparing them pairwise makes clear that

$$\mu_j \min\{p_L w + (q_j - p_L)R;\ s\} \geq \mu_j \min\{p_H w + (q_j - p_H)R;\ s\},$$

for all $s \geq (q_L - p_H)R$; $w \leq R$; and $j = L; H$: Moreover, within the speci¯ed ranges for s and w, this relationship holds with equality for $j = L; H$ only if $s = (q_L - p_H)R$: For this value of s; the incentive compatibility condition (3) reduces to:

$$\mu_0 \phi w + \mu_L[C - (q_L - p_H)R] \geq B;$$

whereas for values of s above $(q_L - p_H)R$ some extra negative terms will appear in the LHS, tightening the corresponding constraint on w.¥

Proof of Proposition 3 Suppose ¯rst that the optimal contract speci¯es $s < (q_L - p_H)R$ so that $r = 1$ at $(p_H; q_L)$. Then the decisions (and possible renegotiations) on replacement imply

$$V = \mu_0 p_H(R - w) + \mu_L(q_L R - s) + \mu_H(q_H R - s);$$

whereas incentive compatibility requires that (4) is satis¯ed. Clearly, since V is decreasing in w and s; the optimal contract should set $(w; s) = (w_I^{\alpha}; 0)$; where

$$w_I^{\alpha} = \frac{B}{\mu_0 \phi}$$

is the bonus that satis¯es (4) with equality. Under this contract, shareholders will obtain:

$$V_I^{\alpha} = AR - \frac{p_H}{\phi} B + \mu_L(q_L - p_H)R;$$

where $A = (\mu_0 + \mu_L)p_H + \mu_H q_H$.

Suppose next that the optimal contract speci¯es $s \geq (q_L - p_H)R$ so that $r = 0$ at $(p_H; q_L)$. In this case the decisions (and possible renegotiations) on replacement

imply

$$V = \pi_0 p_H(R - w) + \pi_L[p_H R - \min\{p_H w;\ s - (q_L - p_H)R\}]$$
$$+\pi_H[q_H R - \min\{p_H w + (q_H - p_H)R;\ s\}]:$$

This expression is also decreasing in w and s: Moreover we have already discussed that setting $s > (q_L - p_H)R$ would tighten the corresponding incentive compatibility constraint. Hence it is optimal to set $(w;s) = (w_I^{\alpha\alpha};s_I^{\alpha\alpha})$ where

$$w_I^{\alpha\alpha} = \frac{B - \pi_L[C - (q_L - p_H)R]}{\pi_0 \Delta}$$

is the bonus that satisfies (5) with equality, whereas

$$s_I^{\alpha\alpha} = (q_L - p_H)R$$

is the minimum severance pay that dissuades shareholders from replacing the incumbent manager at $(p_H;q_L)$: Under this contract, shareholders will get

$$V_I^{\alpha\alpha} = AR - \frac{p_H}{\Delta}[B - \pi_L[C - (q_L - p_H)R]] - \pi_H(q_L - p_H)R:$$

The comparison of V_I^{α} and $V_I^{\alpha\alpha}$ determines which contract is the best. ¥

Proof of Proposition 4 To examine the various renegotiation possibilities, suppose first that either (11) or (12) fail so $d = 0$: The renegotiation will then consist in finding an alternative severance pay $s' \geq 0$ (expectably higher than s) such that both the CEO and the shareholders gain by setting $r = 1$ and enforcing s': Given the status-quo payoffs, a proposal s' is acceptable to shareholders if it verifies $qR - s' \geq p(R - w)$; while it is acceptable to the CEO if it verifies $s' \geq pw + C$. The compatibility of these two inequalities requires

$$(q - p)R \geq C; \tag{25}$$

in which case renegotiation will lead to $r = 1$ and a take-it-or-leave-offer $s' = pw + (q - p)R$ from the CEO to the shareholders such that his pecuniary compensation

will end up being

$$W = pw + (q - p)R:$$

In contrast, if condition (25) fails, the final replacement decision will be $r = d = 0$; and the (expected) pecuniary compensation of the CEO will be

$$W = pw;$$

as stipulated in the initial contract.

Suppose next that conditions (11) and (12) hold so $d = 1$: In this case the renegotiation will consist in specifying an alternative salary $w' \geq 0$ (expectably higher than w) for the incumbent CEO such that both parties end up (weakly) better off setting $r = 0$ and enforcing w' rather than w. Given the status-quo payoffs associated with $d = 1$ under the initial contract, a mutually acceptable w' should satisfy $p(R - w') \geq qR - s$ on the shareholders' side, and $pw' + C \geq s$ on the CEO side. But then, a mutually beneficial renegotiation requires

$$(q - p)R \leq C;$$

which is impossible given (11) and (12). Therefore the final replacement decision will be $r = d = 1$; and the pecuniary compensation of the CEO will be $W = s$, as stipulated in the initial contract. Reordering the relevant conditions, we get the results stated in the proposition.¥

Proof of Proposition 5 Proposition 4 suggests considering contracts within three classes: (a) $s \leq p_L w + C$; (b) $p_L w + C < s \leq p_H w + C$; and (c) $s > p_H w + C$: Consider first contracts of class (b). The value of the firm is

$$V = AR - p_H w - \mu_H (q_H - p_H)R; \tag{26}$$

which is decreasing in w and independent of s; while the incentive compatibility constraint (13) requires

$$\mu_0 \cdot w + \mu_L (p_H w - s) + \mu_H (p_H w - s) + \mu_H (q_H - p_H)R \geq B - \mu_L C; \tag{27}$$

which imposes a lower bound on w: Since reducing s loosens the bound on w but is innocuous for (26), the best contract within this class implies a severance pay at the minimum admissible value $s = p_L w + C$: Under this choice, the lowest value of w that satisfies (27) is

$$w_D^{\alpha} = \frac{B - \mu_H[(q_H - p_H)R - C]}{\phi}$$

which leads to

$$V_D^{\alpha} = AR - \frac{p_H}{\phi}[B - \mu_H[(q_H - p_H)R - C]] - \mu_H(q_H - p_H)R:$$

Notice that the non-negativity of w_D^{α} is guaranteed by the assumption $B > \mu_H[(q_H - p_H)R - C]$.

Consider next contracts of class (a). Shareholders' payoff has the same expression as in (26), decreasing in w and independent of s: However the incentive compatibility condition is now

$$\phi w - \mu_L(q_L - p_L)R - \mu_H \phi R \geq B - \mu_L C;$$

that imposes a lower bound on w clearly larger than w_D^{α}: Hence any contract of class (a) will be strictly dominated by the already identified best contract of class (b).

Consider finally contracts of class (c). The value of the firm is

$$V = AR - \mu_0 p_H w - \mu_L p_H w - \mu_H s; \tag{28}$$

which is decreasing in both w and s; while the incentive compatibility constraint requires

$$\mu_0 \phi w + \mu_L(p_H w - s) \geq B - \mu_L C; \tag{29}$$

which imposes a lower bound on w. Since reducing s loosens the bound on w and increases (28), the best contract within this class implies a severance pay at the minimum admissible value $s = p_H w + C$. Under this choice, the lowest value of w that satisfies (28) is

$$\hat{w} = \frac{B}{\mu_0 \phi}$$

which leads to

$$\hat{V} = AR - p_H \frac{B}{\mu_0 \phi} - \mu_H C.$$

One can easily check, however, that $\mu_0 < 1$ and $(q_H - p_H)R > C$ imply $V_D^{\alpha} > \hat{V}$. Hence the best contract of class (c) is also dominated by the already identified best contract of class (b), which, consequently, is the optimal contract. ¥

Proof of Proposition 6 The argument is based on Figure 2. Condition $V_I^{\alpha} = V_I^{\alpha\alpha}$ is equivalent to

$$[(\mu_L + \mu_H)(p_H - p_L) + \mu_L p_H](q_L - p_H)R - \mu_L p_H C = 0;$$

that defines the downward sloping straight line L_1 in the figure. This line goes through the point $(p_L; C) = (p_H; (q_L - p_H)R)$; which is denoted by P_1. Points below L_1 imply $V_I^{\alpha} > V_I^{\alpha\alpha}$. Similarly, condition $V_I^{\alpha} = V_D^{\alpha}$ is equivalent to

$$[\mu_L p_H (q_L - p_H) - (\mu_L + \mu_H) p_L (q_H - p_H)]R + \mu_H p_H C = 0;$$

that defines the upward sloping line L_2: This line passes through the point $(p_L; C) = (p_H; (q_H - p_H)R)$; which is denoted by P_2. Points to the left of L_2 imply $V_I^{\alpha} > V_D^{\alpha}$. Finally, the condition $V_I^{\alpha\alpha} = V_D^{\alpha}$ is equivalent to

$$[(\mu_L + \mu_H) p_H (q_L - p_H) + \mu_H p_L (q_H - q_L)]R - (\mu_L + \mu_H) p_H C = 0$$

that defines the upward sloping line L_3 (with slope smaller than that of L_2) that passes through the point $(p_L; C) = (0; (q_L - p_H)R)$; which is denoted by P_3. Points to the left of L_3 imply $V_I^{\alpha\alpha} > V_D^{\alpha}$. The three lines intersect at a single point and end up dividing the parameter space in the three regions depicted in Figure 2. To prove the results stated in the proposition, notice that changes in μ_H and μ_L do not move P_1; P_2, and P_3 but produce rotations in L_1; L_2, and L_3 around these points. In particular, increasing μ_H relative to μ_L increases the absolute value of the slope of L_1; decreases the slope of L_2 and increases the slope of L_3: The implied changes

expand the region where D^{α} dominates and contract the region where $I^{\alpha\alpha}$ dominates, which proves the result. ¥

Proof of Proposition 7 Consider first the firms with an independent board. According to Figure 2, if C is low they will use I^{α}; that is, $w = w_I^{\alpha} > w_I^{\alpha\alpha}$ and $s = 0 < s_I^{\alpha\alpha}$; where w_I^{α} is invariant to C. As C increases, firms will switch to $I^{\alpha\alpha}$; where $w_I^{\alpha\alpha}$ is decreasing in C; while $s_I^{\alpha\alpha}$ is invariant to C -see Proposition 3. Consider next the firms with a dependent board. In this case all of them use $w = w_D^{\alpha}$; which is increasing in C; and $s = s_D^{\alpha}$; which is also increasing in C -see Proposition 5. ¥

Proof of Proposition 8 To compute G_{ij} for $i; j = L; H$; notice that if no takeover occurs in a state $(p_i; q_j)$; then the renegotiations on replacement at the CEO-controlled board given $s = 0$ will leave shareholders at their status quo payoff $p_i(R - w)$, irrespectively of the final decision on r: In contrast, if a takeover sets an independent board, then shareholders can directly choose $r = 1$ and guarantee themselves a payoff of $q_j R$: Thus

$$G_{ij} = (q_j - p_i) + p_i w; \tag{30}$$

which implies the ordering stated in the proposition. ■

Proof of Proposition 9 By (17), for a CEO-controlled board cum takeovers to implement $r = 1$ in state $(p_L; q_L)$ and $r = 0$ in state $(p_H; q_L)$; we need

$$G_{HL} < \frac{Á}{®} < G_{LL}; \tag{31}$$

which, from Proposition 8, implies takeovers occur in $(p_L; q_L)$ and $(p_L; q_H)$; but not in $(p_H; q_L)$: However, depending on the relative position of G_{HH} and $\frac{Á}{®}$ they may or may not occur also in $(p_H; q_H)$:

Case 1. Suppose $G_{HH} > \frac{Á}{®}$; so a takeover occurs also in $(p_H; q_H)$: Together with (30)

and (31), this means that w must satisfy

$$(q_L - p_H)R + p_H w < \frac{Á}{®} < \min\{q_L R;\ (q_H - p_H)R + p_H w\}. \tag{32}$$

But, given the associated replacement policy, the incentive compatibility condition for $p = p_H$ requires:

$$¼_0(p_H w + C) + ¼_L(p_H w + C) + ¼_H 0 \geq B + ¼_0 C + ¼_L 0 + ¼_H 0.$$

Consider the contract for which this condition is binding, that is

$$w = \frac{B - ¼_L C}{p_H(¼_0 + ¼_L)}.$$

Then, compatibility with (32) requires

$$\frac{Á}{®} \geq \left(q_L - p_H\right)R + \frac{B - ¼_L C}{¼_0 + ¼_L};\ \min\left\{q_L R;\ (q_H - p_H)R + \frac{B - ¼_L C}{¼_0 + ¼_L}\right\}.$$

Case 2. Suppose $G_{HH} > \frac{Á}{®}$; so there is no takeover in $(p_H; q_H)$: Together with (30) and (31), this means that w must satisfy

$$(q_H - p_H)R + p_H w < \frac{Á}{®} < q_L R. \tag{33}$$

Considering the renegotiation that will occur in state $(p_H; q_H)$; the incentive compatibility condition now becomes:

$$p_H w + ¼_0 C + ¼_L C + ¼_H(q_H - p_H)R \geq B + ¼_0 C;$$

which is binding for

$$w = \frac{B - ¼_L C - ¼_H(q_H - p_H)R}{p_H}.$$

This value of w is positive if $B - ¼_L C - ¼_H(q_H - p_H)R > 0$ and compatible with (33), if

$$\frac{Á}{®} \geq \left((¼_0 + ¼_L)(q_H - p_H)R + B - ¼_L C;\ q_L R\right).$$

The union of the intervals obtained in each of the two cases gives the interval in condition (19). Finally, notice that in both cases the proposed contract yields a value for shareholders of $AR - B + ¼_L C > \max\{V_I^{¤}; V_I^{¤¤}\}$. ■