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RESEARCH ARTICLE

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Contests to become CEO: incentives, selection and handicaps

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Abstract Should a firm favor insiders (handicap outsiders) when selecting a CEO? One reason to do so is to take advantage of the contest to become CEO as a device for providing current incentives to employees. An important reason not to do so is that this can reduce the ability of future CEOs and, hence, future profits. The trade-off between providing current incentives and selecting the most able individual to become CEO is the focus of this paper. If insiders are good enough (better or nearly as good as outsiders), incentive provision to insiders typically dominates and it is optimal to handicap outsiders, sometimes so severely that they have no chance to win the contest. However, if outsiders are sufficiently better than insiders, selection dominates and it is the insiders who are severely handicapped. This finding is in sharp contrast to the existing literature which has so far ignored this trade-off. In all, our model provides useful insight into contests to become CEO and rationalizes empirical regularities in the source of CEOs chosen by firms. In particular, our analysis helps to explain the lower tendency of firms in more heterogeneous industries and firms with a product or line of business organizational structure to select an outsider as CEO.

Keywords Contests · CEO contracts · Moral hazard

JEL Classification Numbers D21 · D82 · L2

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1 Introduction

Promotion contests offer a way for firms to provide high-power incentives to employees, inducing them to exert effort. Moreover, the strength of promotion incentives typically is greater the less likely it is that an outsider will be chosen over all current employees to fill an open job. So handicapping outsiders (favoring current employees when filling higher level jobs) typically strengthens the incentive provided by a promotion contest. Firms can also provide high-power incentives through rewards tied to performance. In a world where verifiability to outsiders or commitment is not an issue, firms will have flexibility in selecting the optimum mix of mechanisms to provide incentives. By contrast, in the presence of verifiability or commitment problems, predetermined payments may be the only viable monetary scheme that can be stipulated by contracts, and handicapping outsiders when filling higher level jobs can be the only feasible way to provide high-power incentives. Monetary bonuses that reward employee performance invite opportunism when effort is not verifiable to outsiders. For example, executives can make themselves better off by rewarding those employees who offer favors or side payments rather than those who have performed the best.[1] Whereas this is an issue for lower level employees, it certainly is not an issue for those at the top, who can obviously commit to rewarding themselves based on their performance. Further, firms should always be able to precommit to favoring able insiders for promotion to higher levels. This is because reneging on such a promise would affect the future performance of the firm and, hence, the value of the stock or options held by its top decision makers.

The focus of this paper is the contest to become Chief Executive Officer (CEO) and the optimal size of the handicap imposed on outsiders when there are verifiability or commitment problems. However, the analysis applies more generally to promotion contests.

One issue that has been ignored by the existing literature on promotion incentives is that while favoring insiders when filling higher level jobs induces greater current effort, it also has an important future cost. Bypassing a more able outsider to promote an insider reduces employee ability and so expected profits in the future. This paper analyzes the trade-off between providing incentives to current employees competing to become CEO and selecting the most able individual as CEO. The analysis is complicated by the fact that the incremental probability of success with effort is not monotonic in the size of the handicap. Taking this into consideration, we find that outsiders typically will be handicapped in the contest to become CEO, sometimes so severely that they cannot win. However, when outsiders are sufficiently better than insiders the gain from selecting a more able CEO dominates concerns for current insider incentives. In this case and in sharp contrast to the existing literature, insiders will be severely handicapped.

A second issue that has received little attention in the existing literature is that the incentive provided to insiders by the contest to become CEO can be increased by promising to handicap outsiders or by promising rents (a payment over the reservation utility) to a promoted insider. Unlike the promise to handicap outsiders, a firm may or may not be able to precommit to future rents. A number of factors make precomitment to future rents problematic. One is regulation (or its threat). CEO pay

[1] Miller (2005) provides an example where employees at Dupont's fibers division ignored a bonus plan which could be manipulated by the choice of accounting procedures.

is public information, and high pay is the stuff of media exposés and Congressional hearings. Since CEO selection policies are not public, they do not face the same regulatory constraints. A second factor is firm liquidity. Future financial exigencies may preclude making a large monetary payment to an incoming CEO, but the same exigencies do not impinge on the promise to favor insiders in the selection of the CEO. A third factor is that the uncertain tenure of the board of directors may make it easier to precommit to favoring insiders in the more immediate selection of a CEO than to the more distant payment of future rents. Especially where mergers and takeovers may occur, it may be impossible to precommit to distant promises. Our analysis focuses on the case where a firm cannot precommit to future rents, but we do consider an extension in which such precommitment is possible.

1.1 Setting

To provide a setting for the model that we develop, consider the position of CEO and its associated compensation as the prize awarded to the winner of a contest to become the firm's CEO. Some participants in this contest are insiders who already work for the firm and who are seeking promotion; some are outsiders who would join the firm only if they were picked as CEO. A look at who typically wins the contest to become CEO suggests that outsiders are disadvantaged. Parrino (1997) finds that, over the period 1969–1989, large U.S. firms selected outsiders as CEO only about 15% of the time.

A substantial outsider disadvantage is not the only empirical regularity. Larger firms are less likely to pick an outsider as CEO (Parrino 1997; Agrawal, Knoeber, Tsoulouhas 2005). Firms in more homogeneous industries are more likely to pick an outsider as CEO Parrino 1997; Agrawal et al. 2005. And firms organized by product (Chevrolet, Pontiac . . .) or line of business (chocolate, pasta . . .) as contrasted to a functional organization (finance, marketing . . .) are less likely to pick an outsider as CEO (Agrawal et al. 2005).

1.2 Framework

Motivated in part by these empirical regularities, we develop a model of the CEO selection contest in the spirit of Lazear and Rosen (1981). This seminal paper addresses the problem faced by an employer who must design a tournament (contest) among employees that provides them with incentives to exert a desired level of effort. An important result is that this tournament provides greater incentive as the prize awarded to the winner increases and as the link between added effort and the chance of winning becomes stronger. When outsiders (non-employees) are allowed in the contest, the link between effort by an insider and his chance of winning typically weakens, and insider incentives are reduced. To restore incentives, the prize (awarded to insiders if they win) could be increased or outsiders could be handicapped (disadvantaged). Because increasing the prize would invite opportunistic behavior (cheating by the employer or sabotage among workers), handicapping can be a more desirable option. The provision of incentives to insiders, then, offers a rationale for the disadvantage that outsiders face in the contest to become CEO and for their relative lack of success in this contest.

In this paper, we too focus on the incentive effect that the contest to become CEO has on inside contestants. But we also focus on the value to the firm from picking a better CEO. In our model, handicapping outsiders can have a beneficial incentive effect (inducing insiders to work harder) but it can also have a cost if it makes the selection of a less able (insider) CEO more likely.[2] Incorporating the value to a firm from picking a better CEO is important. Absent this, typically there is no reason for a firm to include outsiders in its contest to become CEO; this simply reduces the incentives of insiders without any gain to the firm. Moreover, looking only at the incentive effect of the contest to become CEO (e.g. Chan 1996) significantly affects results. In this partial framework, having more able outsiders leads to a greater handicap imposed on outsiders. By contrast, we show that more able outsiders leads to a reduced outsider handicap and may even result in a handicap imposed on insiders. Indeed, the gain from selecting a more able CEO may completely dominate concerns for insider incentives.

We focus on the case where a firm cannot credibly promise a winning insider any more than his reservation utility in the future. If the insiders are good enough (better or nearly as good as outsiders) and if their incentive compatibility constraints (i.e., the constraints which ensure that insiders are provided with sufficient incentives to exert effort) are non-binding, the outsiders are handicapped severely to maximize the chance that an insider will win, thereby inducing the participation of insiders at least cost to the firm. If the constraints are binding, the handicap imposed on outsiders is smaller, to reduce the probability that a shirking insider wins, and it falls (possibly becoming negative) as outsiders become more able. The handicap also falls as the common shocks to performance faced by outsiders become more similar to those faced by insiders; and it can rise as the common shocks faced by insiders become more important. Finally, for very able outsiders, insiders are always severely handicapped.

In an extension, we consider the case where a firm can precommit to paying future rents to an insider promoted to CEO. The ability to precommit to future rents typically increases the size of the handicap imposed on outsiders, but it will not when the incentive constraints are binding and insiders are about as good as outsiders. In the latter case, interestingly, the greater ability to precommit to its employees makes a firm *less* loyal to these employees.

In what follows, we begin in Section 2 by developing a model of the contest to become CEO. This model specifies how a winner is determined and characterizes the probability that a representative insider will be selected CEO. In Section 3, we derive the optimal payments to insiders competing to be CEO, the optimal payment(s) to the winner of the CEO contest, and the optimal handicap to impose on outside contestants. This is the core of our analysis. Section 3.3 considers extensions. Here, we first use the model to provide insight into two empirical regularities in the selection of CEOs – that firms in more homogeneous industries are less likely to promote an insider to CEO and that firms organized by product divisions are more likely to promote an insider to CEO. We then extend the model to allow firms to precommit to paying future rents to an insider selected as CEO. Section 4 concludes the paper.

[2] This cost can be characterized as an example of the *Peter Principle* (people are promoted to their levels of incompetence). See J.R. Faria (2000, unpublished) and Lazear (2004).

2 The model

In this section we develop a model that specifies how a winner of the contest to become CEO is determined and we characterize the probability that an insider competing to become CEO will be successful. We consider a two-period framework and assume that all internal contestants (employees) receive a predetermined salary in the first period. Incentives to exert effort in this period derive solely from the contest to become the second period CEO. The prize for winning this contest is a share of the second period output of the firm.

Denote the two periods $t = 0$ and $t = 1$. In $t = 0$, N^I internal contestants compete for a CEO position to be awarded in $t = 1$. Every internal contestant receives a payment r_o in $t = 0$. For simplicity, losers are assumed to leave the firm and to receive a reservation utility, normalized to zero, elsewhere. If an internal contestant wins the CEO contest, his payment in $t = 1$ is a share $S^I \in (0, 1)$ of his output as CEO. Think of the CEO as producing profits so that the CEO's output is the firm's profits. We model the payment to the CEO (the prize for winning the contest to become the CEO) as a share of the CEO's output (firm profits) partly to be consistent with the actual importance of stock based rewards (shareholding and stock options) in CEO compensation and partly to emphasize that the contest to become CEO provides incentive only to those still competing, not to the recent winner (Rosen 1986). Something like a sharing contract is necessary to motivate effort by the CEO.[3] Internal contestants (along with everyone else) are assumed to be risk-neutral, however, they are liquidity constrained so that r_o cannot be negative.

The contest to become CEO is open to insiders but also to outsiders. The internal contestants, whom we assume to be of known, homogeneous abilities, compete with an exogenously determined N^X external applicants of unknown abilities α_x, with $\alpha_x \in [\underline{\alpha}, \bar{\alpha}]$. [4] The distribution function of α_x for an external contestant $x \in N^X$ is $F_x(\alpha_x)$, and the density function is $f_x(\alpha_x)$. External contestants are assumed to be *anonymous* in their distributions of abilities; that is, $F_x(\cdot) = F(\cdot), \forall x$. This means that neither the firm nor the internal contestants can directly distinguish among outside contestants *ex ante*. The $t = 0$ payments of outside contestants are arranged by their employing firms. If an outside contestant of ability α_x wins our firm's CEO contest, he is awarded a contract paying him a share $S(\alpha_x) \in (0, 1)$ of his $t = 1$ output (firm profits) while serving as CEO. This share depends upon his (now revealed) ability and need not be the same as the share that an internal winner would have received.

Contestant effort is denoted by e_i and e_x for an internal and an external contestant. Internal contestants can exert effort $e_i = e_H$ or shirk by taking action $e_i = e_L$. We assume that external contestants can exert effort $e_x(\alpha_x)$, or they can shirk by taking action $e_x = e_L$ regardless of their abilities. It is costly to contestants when they exert effort. The cost of effort is $c(e_i)$ and $c(e_x(\alpha_x))$.

There is "hidden-action" moral hazard. Effort is not freely observable but output (divisional profits for those competing to become CEO; firm profits for the CEO)

[3] Performance pay is substantially more important for CEOs than for non-CEOs (Aggarwal and Samwick 2003). Our model exaggerates this by assuming that performance pay for non-CEOs is zero.

[4] The number of contestants (insiders or outsiders) is exogenous as in Nalebuff and Stiglitz (1983).

is, and output depends stochastically on effort. Because of this, relative output is used to rank contestants and so to choose the winner of the contest to become CEO. Outputs are denoted by q_i and q_x for internal and external contestants. The relation between output and effort for an internal contestant takes the form $q_i = e_i + \varepsilon_i + \theta^I$, where ε_i is an idiosyncratic shock and θ^I is the common shock faced by all internal contestants. The distributions of the ε_i values are identical and independent. The density and distribution functions are denoted by $g(\varepsilon_i)$ and $G(\varepsilon_i)$. The density $g(\varepsilon_i)$ is unimodal, with zero mean and support equal to the interval $[\underline{\varepsilon}, \bar{\varepsilon}]$. The density and distribution functions of θ^I are $h(\theta^I)$ and $H(\theta^I)$. The density $h(\theta^I)$ has zero mean and support equal to the interval $[\underline{\theta}^I, \bar{\theta}^I]$. So the expected output of an internal contestant is e_H if he exerts effort and e_L if he shirks. Similarly, the output of an external contestant who exerts effort is $q_x = e_x(\alpha_x) + \varepsilon_x + \theta^X$, where ε_x is an idiosyncratic shock and θ^X is the shock that is common among all external contestants. Densities and distribution functions for the uncertainties facing external contestants are $g(\varepsilon_x)$, $G(\varepsilon_x)$, $h(\theta^X)$ and $H(\theta^X)$, where $g(\varepsilon_x)$ and $h(\theta^X)$ have zero mean. The support of ε_x is $[\varepsilon_0, \varepsilon_1]$, while that of $h(\theta^X)$ is $[\underline{\theta}^X, \bar{\theta}^X]$. We make the following *regularity assumptions*. First, $\bar{\theta}^X > \underline{\theta}^I, \bar{\theta}^I > \underline{\theta}^X, e_x(\bar{\alpha}) > e_H > e_x(\underline{\alpha})$ (that is, there is a good pool of outside candidates so that if an external candidate is of the highest possible ability and if he exerts effort, then this effort is larger than the effort of a hard working insider). Second, $e_L < e_x(\underline{\alpha}) < e_L + (\bar{\varepsilon} - \underline{\varepsilon}) + (\bar{\theta}^I - \underline{\theta}^X)$ (which puts bounds on the effort of a low ability outsider).

The probability that an internal contestant i beats some other internal contestant j, given realizations ε_i and θ^I, is the probability that his output $q_i = e_i + \varepsilon_i + \theta^I$ is larger than the output of the other internal contestant $q_j = e_j + \varepsilon_j + \theta^I$, that is,

$$\text{Prob}(q_i \geq q_j) = \text{Prob}(\varepsilon_j \leq e_i - e_j + \varepsilon_i) = G(\varepsilon_i + e_i - e_j) \tag{2.1}$$

The probability that an internal contestant i beats an external contestant x of unknown ability α_x, given realizations ε_i and θ^I, is the probability that his output $q_i = e_i + \varepsilon_i + \theta^I$ is larger than the output of the external contestant $q_x = e_x(\alpha_x) + \varepsilon_x + \theta^X$, that is,

$$\text{Prob}(q_i \geq q_x) = \int_{\underline{\alpha}}^{\bar{\alpha}} \int_{\underline{\theta}^X}^{\bar{\theta}^X} G\left(\varepsilon_i + e_i - e_x(\alpha_x) + \theta^I - \theta^X\right) dH(\theta^X) dF(\alpha_x). \tag{2.2}$$

Thus, the probability that an internal contestant i beats every other internal contestant j and every external contestant x, given realizations ε_i and θ^I, is

$$\prod_{j \neq i} G(\varepsilon_i + e_i - e_j) \times \left(\int_{\underline{\alpha}}^{\bar{\alpha}} \int_{\underline{\theta}^X}^{\bar{\theta}^X} G\left(\varepsilon_i + e_i - e_x(\alpha_x) + \theta^I - \theta^X\right) dH(\theta^X) dF(\alpha_x) \right)^{N^X}. \tag{2.3}$$

Hence, the prior probability that insider i wins is [5]

$$\int_{\underline{\varepsilon}}^{\bar{\varepsilon}} \int_{\underline{\theta}^I}^{\bar{\theta}^I} \prod_{j \neq i} G(\varepsilon_i + e_i - e_j) \left(\int_{\underline{\alpha}}^{\bar{\alpha}} \int_{\underline{\theta}^X}^{\bar{\theta}^X} G\left(\varepsilon_i + e_i - e_x(\alpha_x) + \theta^I - \theta^X\right) dH(\theta^X) dF(\alpha_x) \right)^{N^X} dH(\theta^I) dG(\varepsilon_i). \tag{2.4}$$

We now allow for *handicapping*: an internal contestant i beats an external contestant x if $q_i \geq q_x - \Delta q$, where Δq is a predetermined *gap*. If the gap $\Delta q > 0$, then outsiders are handicapped (disadvantaged). If $\Delta q < 0$, then insiders are handicapped. The prior probability that insider i wins when a handicap is in place, given effort levels for the insiders and given the number of contestants, is

$$\pi_i(e_i, e_j, \Delta q, N^I, N^X) = \int_{\underline{\varepsilon}}^{\bar{\varepsilon}} \int_{\underline{\theta}^I}^{\bar{\theta}^I} \prod_{j \neq i} G(\varepsilon_i + e_i - e_j) \left(\int_{\underline{\alpha}}^{\bar{\alpha}} \int_{\underline{\theta}^X}^{\bar{\theta}^X} G\left(\varepsilon_i + e_i - e_x(\alpha_x) + \theta^I - \theta^X + \Delta q\right) dH(\theta^X) dF(\alpha_x) \right)^{N^X} dH(\theta^I) dG(\varepsilon_i). \tag{2.5}$$

We assume that the probability of insider success increases with effort, that is,

$$\pi_i(e_H, \Delta q, N^I, N^X) > \pi_i(e_i = e_L, e_j = e_H, \Delta q, N^I, N^X), \quad \forall \Delta q, N^I, N^X. \tag{2.6}$$

Lazear and Rosen (1981) and Nalebuff and Stiglitz (1983) have argued that disadvantaging the more able contestants can be consistent with efficient provision of incentives. Because the presence of heterogeneous contestants reduces everyone's incentives to perform, handicapping the more able evens the contest and restores incentives. Here, we investigate a related but distinct issue, namely, the implications of handicapping when the contest is open to outsiders who may be of greater ability. Including outsiders allows the selection of higher ability CEOs, but at a cost since this reduces the likelihood of success by insiders, and so their incentives to work. In principle, the incentives of insiders could be restored by handicapping outsiders so that they will succeed only if they are clearly better, or by increasing the prize (share of firm profits while CEO) awarded to an internal victor. We consider both, but our focus is the optimal handicap.

[5] See Skaperdas (1996) for an axiomatization of contest success functions. However, note that Skaperdas focuses on contests in which contestants can form coalitions, and poses more assumptions than the ones we employ here. He analyzes "power" contest success functions, in which winning probabilities depend on the ratio of players' efforts, and "logit" contest success functions, in which winning probabilities depend only on the difference in the efforts. The latter is closer to ours, but we also distinguish between common and idiosyncratic uncertainty, and incorporate the impact of handicapping some contestants.

3 The optimal contracts

This section characterizes the optimal contracts, that is, the optimal payments to insiders competing to become CEO, the optimal payment to the winner of the CEO contest, and the optimal handicap to be imposed on outside contestants. We assume that a firm benefits when the CEO exerts effort, but the firm may or may not benefit from eliciting effort by the internal contestants for its CEO position. Because effort is more costly to agents than shirking, and because it is not freely observable by the firm (or verifiable to outsiders), the firm may need to provide its employees with incentives to perform. As we demonstrate, providing incentives for insiders to exert effort raises the current profit of the firm, but it may reduce future profit if able outsiders must be handicapped. When the second effect dominates, the firm will choose not to elicit effort from current insiders.

Thus, our interest is optimal incentive contracts, taking into account the potential tension between providing incentives to insiders and selecting the most able to become CEO, and given the prior probability assessment in (2.5) that an insider i wins when a handicap is in place. We begin in Section 3.1 by analyzing the optimal $t = 1$ contract to offer an outsider should he win the contest to become CEO. Section 3.2 examines the optimal $t = 1$ contract to offer an insider should he be selected CEO and the accompanying $t = 0$ contract for all inside contestants. Here, we assume that the firm is not able to precommit to a large prize (share of output) in the second period; that is, the firm will wait until $t = 1$ to offer a contract to a winning insider. The results in this section are the core of our analysis. Section 3.3 contains several extensions including an examination of the effect of allowing the firm to precommit to a large prize should an insider win the contest to become CEO. Here, the firm will promise a contract in $t = 0$ should an insider win, and this precommitted contract will be implemented in $t = 1$.

3.1 The optimal outsider CEO contract

The firm determines the optimal contracts by backward induction. In $t = 1$, the contest to become CEO is over and the origin (internal or external) of the new CEO is known. For simplicity, we assume that should an outsider win his ability becomes known as well, however, the ability of outsiders who did not win is not observable to the firm.[6] When an outsider wins, the firm must select the optimum share $S(\alpha_x)$ to offer to the newly selected CEO (contingent on his ability α_x), to maximize expected output (firm profits) less the payment to the CEO and subject to participation and incentive constraints for the CEO. Note that for ease of exposition we abuse the notation, in particular, we use the same notation for effort in $t = 0$ and for effort of a CEO in $t = 1$. However, effort can take different values in the two periods. Also note that, given our assumptions on the distributions of shocks, expected output is equal to effort.[7] Thus, the firm's $t = 1$ problem when

[6] We could easily generalize the model by assuming that the ability of an outsider CEO is still unknown, or by using the contest performance of the newly chosen CEO to update the prior distribution on his ability.

[7] Note that the output of a CEO of external origin is $q_x = e_x(\alpha_x) + \varepsilon_x + \theta^I$.

an outsider has won the contest is

$$\max_{S(\alpha_x)} (1 - S(\alpha_x))e_x(\alpha_x)$$

subject to

$$S(\alpha_x)e_x(\alpha_x) - c(e_x(\alpha_x)) \geq \bar{U}_{x1}(\alpha_x), \tag{3.1}$$

$$S(\alpha_x)e_x(\alpha_x) - c(e_x(\alpha_x)) \geq S(\alpha_x)e_L - c(e_L), \tag{3.2}$$

$$S(\alpha_x) \in (0, 1), \tag{3.3}$$

where (3.1) is the CEO's ($t = 1$) *individual rationality constraint*, and (3.2) is the CEO's ($t = 1$) *incentive compatibility constraint*. The latter can be rewritten as

$$S(\alpha_x) \geq \frac{c(e_x(\alpha_x)) - c(e_L)}{e_x(\alpha_x) - e_L}, \tag{3.4}$$

meaning that in order to ensure that he exerts effort the CEO's output (profit) share must be at least as large as the marginal cost of his effort. Note that a CEO with a marginal cost of effort greater than or equal to 1 would violate condition (3.3); that is, he would receive more than his contribution (more than firm profits), hence, he would not be made CEO. Thus, we assume that the marginal cost of effort is smaller than 1:

$$\frac{c(e_x(\alpha_x)) - c(e_L)}{e_x(\alpha_x) - e_L} < 1. \tag{3.5}$$

Also note that the firm would like to ensure that the CEO exerts effort but grant him only the minimum necessary rents – zero rents if possible – while still inducing him to accept the contract. The output share just sufficient for a CEO of ability α_x to accept the contract satisfies

$$S^*(\alpha_x) = \frac{\bar{U}_{x1}(\alpha_x) + c(e_x(\alpha_x))}{e_x(\alpha_x)}. \tag{3.6}$$

We assume that the CEO's reservation utility $\bar{U}_{x1}(\alpha_x)$ is sufficiently large so that he receives more than the marginal cost of his effort, that is, (3.4) is automatically satisfied. This is a reasonable assumption, since a contestant who is successful in this firm's CEO contest will likely be attractive to other firms as well, implying a high reservation utility. Given (3.6), the payment that the firm expects in $t = 0$ (before CEO ability becomes known) to make in $t = 1$ to a winning outsider CEO is

$$S^{X*} = \int_{\underline{\alpha}}^{\bar{\alpha}} S^*(\alpha_x) f(\alpha_x) \left[\int_{\varepsilon_0}^{\varepsilon_1} \int_{\underline{\alpha}}^{\bar{\alpha}} G\left(\varepsilon_x + e_x(\alpha_x) - e_y(\alpha_y)\right) dF(\alpha_y) dG(\varepsilon_x) \right]^{N^X - 1} d(\alpha_x). \tag{3.7}$$

Observe, as shown by the terms in the square brackets, that a winning outsider CEO of any given ability α_x must have beaten all other outsiders of unknown ability α_y. The expected payment should an outsider win the contest to become CEO is taken into account in the sections below that characterize the optimal contract(s) to insiders.

3.2 The optimal insider contracts

We assume that the firm is unable to precommit in $t = 0$ to a contract for $t = 1$ should an insider win the contest to become CEO. As a consequence, the firm will offer a contract to the newly promoted CEO in $t = 1$ with the same essential features as that which it would offer an outsider who is selected CEO (i.e., similar to that in (3.6)). That is, the promoted CEO's profit share will be sufficient to induce him to exert effort but will leave him no $t = 1$ rents. Specifically, the CEO's profit share will satisfy

$$S^{I*} = \frac{\bar{U}_1 + c(e_H)}{e_H}, \tag{3.8}$$

where $\bar{U}_1 > 0$ is his reservation utility in $t = 1$ given that he has won the contest.[8] This profit share (along with the expected profit share for an outsider of unknown ability as characterized in (3.7)) enters the determination of the initial period contract. Note that similar to an outsider CEO's effort, we assume that the marginal cost of an insider CEO's effort is smaller than 1:

$$\frac{c(e_H) - c(e_L)}{e_H - e_L} < 1. \tag{3.9}$$

The firm's $t = 0$ problem is to choose the payment r_o and the handicap Δq that maximize expected profit over both periods, subject to intertemporal *individual rationality* and *Nash incentive compatibility constraints* (when the firm benefits by eliciting effort from insiders competing to become CEO), as well as *liquidity constraints* for the internal contestants. For simplicity we assume no discounting. Thus, the $t = 0$ optimum is the solution to

$$\begin{aligned} &\max_{r_o, \Delta q} N^I(e_i - r_o) + N^I \pi_i(e_i, \Delta q, N^I, N^X)(1 - S^{I*})e_H \\ &\quad + [1 - N^I \pi_i(e_i, \Delta q, N^I, N^X)](1 - S^{X*})E(e_x) \end{aligned}$$

subject to

$$(r_o - c(e_i)) + \pi_i(e_i, \Delta q, N^I, N^X)\bar{U}_1 \geq \bar{U}_o, \quad \forall i, \tag{3.10}$$

$$\begin{aligned} &(r_o - c(e_H)) + \pi_i(e_H, \Delta q, N^I, N^X)\bar{U}_1 \\ &\quad \geq (r_o - c(e_L)) + \pi_i(e_i = e_L, e_j = e_H, \Delta q, N^I, N^X)\bar{U}_1, \quad \forall i \Leftrightarrow \\ &\quad \Leftrightarrow [\pi_i(e_H, \Delta q, N^I, N^X) - \pi_i(e_i = e_L, e_j = e_H, \Delta q, N^I, N^X)]\bar{U}_1 \\ &\quad \geq c(e_H) - c(e_L), \forall i, \end{aligned} \tag{3.11}$$

$$r_o \geq 0, \tag{3.12}$$

[8] We assume that a successful insider will have greater outside opportunities, which makes his reservation utility larger than that of an unsuccessful insider.

where $N^I \pi_i(e_i, \Delta q, N^I, N^X)$ is the probability that an insider wins the contest, $1 - N^I \pi_i(e_i, \Delta q, N^I, N^X)$ is the probability that an outsider wins the contest,

$$E(e_x) = \int_{\underline{\alpha}}^{\bar{\alpha}} e_x(\alpha_x) f(\alpha_x) \times \left[\int_{\varepsilon_0}^{\varepsilon_1} \int_{\underline{\alpha}}^{\bar{\alpha}} G\left(\varepsilon_x + e_x(\alpha_x) - e_y(\alpha_y)\right) dF(\alpha_y) dG(\varepsilon_x) \right]^{N^X - 1} d(\alpha_x) \tag{3.13}$$

is the expected output from a winning outsider CEO, given that a winning outsider of any given ability α_x must have beaten all other outsiders of unknown ability α_y,

$$\begin{aligned} &\pi_i(e_H, \Delta q, N^I, N^X) \\ &= \int_{\underline{\varepsilon}}^{\bar{\varepsilon}} \int_{\underline{\theta}^I}^{\bar{\theta}^I} (G(\varepsilon_i))^{N^I - 1} \left(\int_{\underline{\alpha}}^{\bar{\alpha}} \int_{\underline{\theta}^X}^{\bar{\theta}^X} G\left(\varepsilon_i + e_H - e_x(\alpha_x) + \theta^I - \theta^X + \Delta q\right) \right. \\ &\qquad \left. \times dH(\theta^X) dF(\alpha_x) \right)^{N^X} dH(\theta^I) dG(\varepsilon_i) \end{aligned} \tag{3.14}$$

is the probability that insider i wins the contest when all contestants exert effort, and

$$\begin{aligned} &\pi_i(e_i = e_L, e_j = e_H, \Delta q, N^I, N^X) \\ &= \int_{\underline{\varepsilon}}^{\bar{\varepsilon}} \int_{\underline{\theta}^I}^{\bar{\theta}^I} (G(\varepsilon_i + e_L - e_H))^{N^I - 1} \left(\int_{\underline{\alpha}}^{\bar{\alpha}} \int_{\underline{\theta}^X}^{\bar{\theta}^X} G\left(\varepsilon_i + e_L - e_x(\alpha_x) \right.\right. \\ &\qquad \left.\left. + \theta^I - \theta^X + \Delta q\right) dH(\theta^X) dF(\alpha_x) \right)^{N^X} dH(\theta^I) dG(\varepsilon_i) \end{aligned} \tag{3.15}$$

is the probability that insider i wins the contest when he shirks and the rest of the contestants exert effort.

Note that we assume the firm always allows all employees to compete to be CEO. That is, even though all employees are homogeneous, the firm will not pick one at random to compete to become CEO. Instead, in (3.16) below, we assume that the firm wants all insiders to compete and to exert effort. Let Δq^* denote the optimal handicap when all internal contestants compete and exert effort, and $\Delta q^{*\sim}$ the optimal handicap provided to one insider who is picked at random to compete against the outsiders, while the rest of the insiders are not provided with such an incentive and, hence, shirk.

$$\begin{aligned} &N^I[e_H - r_o^*(e_H, \Delta q^*, N^I, N^X)] + N^I \pi_i(e_H, \Delta q^*, N^I, N^X)(1 - S^{I*}) e_H \\ &\quad + [1 - N^I \pi_i(e_H, \Delta q^*, N^I, N^X)](1 - S^{X*}) E(e_x) \\ &\qquad > e_H - r_o^{*\sim}(e_H, \Delta q^{*\sim}, N^X) + (N^I - 1)[e_L - r_o^{*\sim}(e_L)] \\ &\qquad\quad + \pi_i(e_H, \Delta q^{*\sim}, N^X)(1 - S^{I*}) e_H \\ &\qquad\quad + [1 - \pi_i(e_H, \Delta q^{*\sim}, N^X)](1 - S^{X*}) E(e_x). \end{aligned} \tag{3.16}$$

The left-hand side of the inequality shows the firm's expected profit over both periods when all internal contestants compete and exert effort, and the right-hand side shows the corresponding profit when one insider is picked at random to compete against the outsiders. The rationale behind our assumption is that while excluding insiders can benefit the firm by allowing a change in the size of the handicap, it also involves a cost because the $N^I - 1$ excluded insiders shirk. Condition (3.16) guarantees the cost of shirking is always larger.

The firm maximizes expected profit over all periods, given the prior probability assessment $\pi_i(\cdot)$ that an insider wins the contest to become CEO (characterized in Section 2), and given the optimal second-period contracts for a CEO of external origin (characterized in Section 3.1) or internal origin (characterized in the beginning of this section). Constraint (3.10) is the individual rationality constraint ensuring the initial participation of an internal contestant because he receives his *ex ante* reservation utility $\bar{\text{U}}_o$, given the prior assessment $\pi_i(\cdot)$. Constraint (3.11) is the Nash incentive compatibility constraint ensuring that no internal contestant i will unilaterally shirk when the rest of the contestants exert effort. This constraint is applied only when the firm benefits by implementing a contract that elicits effort from the internal contestants. The incentive compatibility constraint incorporates the intertemporal incentives of the contestant; by shirking in $t = 0$ the contestant reduces the cost of effort $c(\cdot)$, but he also reduces the probability $\pi_i(\cdot)$ of becoming CEO. Constraint (3.12), the liquidity constraint, implies that the enterprise cannot be "sold" to the contestant in equilibrium. To simplify the analysis, we make the *regularity assumption* that $\bar{\text{U}}_o + c(e_L) > \bar{\text{U}}_1$ which, as shown below, makes the liquidity constraint non-binding.

Observe that the incentive compatibility constraint (3.11) is independent of the $t = 0$ payment r_o; whereas r_o is important for agent participation, it is the handicap Δq as well as the $t = 1$ prize (profit share) that are the critical factors for insider incentives to exert effort. With a handicap in place, effort determines the probability of winning the $t = 1$ prize $\bar{\text{U}}_1$ (in utility terms). Since (3.11) is independent of r_o, r_o is determined entirely by the individual rationality constraint (3.10). For any given Δq, the firm can always reduce r_o to the smallest value that satisfies the individual rationality constraint with equality, without hurting incentives to perform. An insider will receive no rents, but he will still accept the contract. Thus,

$$r_o^* = \bar{\text{U}}_o + c(e_i) - \pi_i(e_i, e_j, \Delta q^*, N^I, N^X)\bar{\text{U}}_1 > 0.^9 \tag{3.17}$$

Equation (3.17) implies that the inside contestants' liquidity constraints are non-binding.

As argued above, the $t = 1$ payment to a successful insider who is promoted to the CEO position (the prize) will be determined in $t = 1$ and will yield no $t = 1$ rents (i.e., it will yield a payoff $\bar{\text{U}}_1$). The handicap Δq is the only tool available to the firm to elicit $t = 0$ effort from insiders. But it may not be in the firm's interest to do so. Eliciting effort adds to current period profit, but it may have a future cost since handicapping outsiders can lead to a less able CEO next period and so lower expected second period profits. Indeed, if outsiders are sufficiently able, the firm may want to handicap the insiders, discouraging their effort. Our remaining task is to determine the optimal handicap Δq^*.

[9] The payment $r_o^* > 0$ because $\bar{\text{U}}_o + c(e_L) > \bar{\text{U}}_1$, hence, $\bar{\text{U}}_o + c(e_H) > \pi_i(e_H,)\Delta q, N^I, N^X)\bar{\text{U}}_1$.

The value of Δq^* depends critically on whether the incentive compatibility constraint is binding or not. To determine whether the constraint is binding, we start by solving the problem without the constraint, to find out if the constraint is automatically satisfied. In principle, absent the incentive constraint, the firm can choose $\Delta q^* \geq 0$ or < 0, and the internal contestants can select effort e_H or e_L. We focus on two main cases. If insiders are "good enough," meaning better, similar or not much worse than outsiders in a specific sense defined in (3.20) below, the firm will want to choose a Δq^* that provides incentives to insiders to exert effort. If the outsiders are "sufficiently better", however, the firm will want to provide disincentives to insiders so that they do not exert effort, in order to minimize their probability of success. Let Δq^{*--} denote the optimum handicap in this case.

The firm will find it optimal to implement Δq^* rather than Δq^{*--} if expected profit is greater:

$$\begin{aligned} &N^I(e_H - r_o^*) + N^I\pi_i(e_H, \Delta q^*, N^I, N^X)(1 - S^{I*})e_H \\ &\quad + [1 - N^I\pi_i(e_H, \Delta q^*, N^I, N^X)](1 - S^{X*})E(e_x) \\ &\qquad \geq N^I(e_L - r_o^{*--}) + N^I\pi_i(e_L, \Delta q^{*--}, N^I, N^X)(1 - S^{I*})e_H \\ &\qquad\quad + [1 - N^I\pi_i(e_L, \Delta q^{*--}, N^I, N^X)](1 - S^{X*})E(e_x). \end{aligned} \tag{3.18}$$

(Note that in Propositions 2 and 3 we use $\Delta q^{*\prime}$ instead of Δq^*.) Given (3.17), (3.18) reduces to

$$\begin{aligned} &[e_H - c(e_H)] + \pi_i(e_H, \Delta q^*, N^I, N^X)[(1 - S^{I*})e_H - (1 - S^{X*})E(e_x) + \bar{\text{U}}_1] \\ &\quad \geq [e_L - c(e_L)] + \pi_i(e_L, \Delta q^{*--}, N^I, N^X) \\ &\qquad \times [(1 - S^{I*})e_H - (1 - S^{X*})E(e_x) + \bar{\text{U}}_1]. \end{aligned} \tag{3.19}$$

Given (3.19), if insiders are good enough so that expected $t = 1$ profit from insiders relative to outsiders satisfies

$$\begin{aligned} &(1 - S^{I*})e_H - (1 - S^{X*})E(e_x) + \bar{\text{U}}_1 \\ &\quad \geq \frac{[e_L - c(e_L)] - [e_H - c(e_H)]}{\pi_i(e_H, \Delta q^*, N^I, N^X) - \pi_i(e_L, \Delta q^{*--}, N^I, N^X)}, \end{aligned} \tag{3.20}$$

then the firm will want to implement Δq^*. By contrast, if outsiders are sufficiently better, that is, if the expected profit from an outsider CEO is sufficiently greater than that from an insider so that

$$\begin{aligned} &(1 - S^{I*})e_H - (1 - S^{X*})E(e_x) + \bar{\text{U}}_1 \\ &\quad < \frac{[e_L - c(e_L)] - [e_H - c(e_H)]}{\pi_i(e_H, \Delta q^*, N^I, N^X) - \pi_i(e_L, \Delta q^{*--}, N^I, N^X)} < 0, \end{aligned} \tag{3.21}$$

then the firm will want to provide disincentives to insiders so that they do not exert effort, by implementing $\Delta q^{*--} < 0$.[10]

When insiders are good enough so that (3.20) holds, or when outsiders are sufficiently better so that (3.21) holds, there are two possibilities. If the $t = 1$ reservation

[10] Note that condition (3.9) implies $e_H - c(e_H) > e_L - c(e_L)$, that is, social surplus in $t = 0$ alone is larger when internal contestants exert effort, in addition, $\pi_i(e_H, \Delta q^*, N^I, N^X) > \pi_i(e_L, \Delta q^{*--}, N^I, N^X)$, that is the probability of an insider's success when he exerts effort and outsiders are handicapped is larger than that when he shirks while he is handicapped.

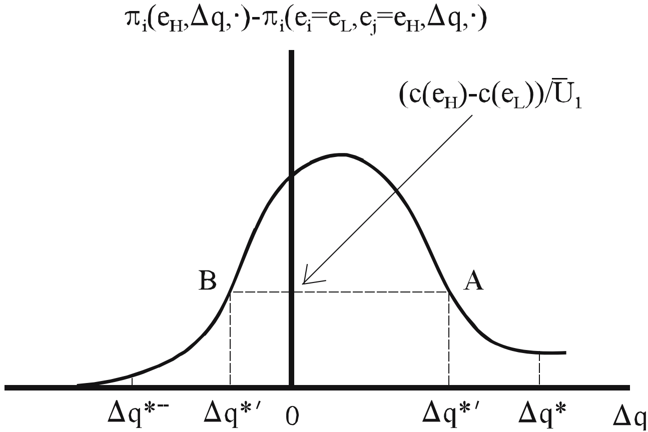

Fig. 1 Difference in probabilities of success

utility of an insider who is promoted to the CEO position is large relative to the incremental cost of his $t = 0$ effort, that is, if

$$\bar{\text{U}}_1 > \frac{c(e_H) - c(e_L)}{\pi_i(e_H, \Delta q^*, N^I, N^X) - \pi_i(e_i = e_L, e_j = e_H, \Delta q^*, N^I, N^X)}, \tag{3.22}$$

the incentive compatibility constraint is automatically satisfied by the solution obtained from solving without the constraint, and the constraint is non-binding. The intuition is that if insiders expect a large prize from becoming CEO in $t = 1$ relative to the incremental cost of exerting effort in $t = 0$, then insiders motivate themselves to perform without additional incentive from the firm. By contrast, if the $t = 1$ reservation utility is small relative to the $t = 0$ incremental cost of exerting effort, that is, if

$$\bar{\text{U}}_1 < \frac{c(e_H) - c(e_L)}{\pi_i(e_H, \Delta q^*, N^I, N^X) - \pi_i(e_i = e_L, e_j = e_H, \Delta q^*, N^I, N^X)}, \tag{3.23}$$

then the solution without the incentive constraint, Δq^*, violates the constraint, and the constraint is binding when the firm benefits by implementing insider effort. (Note that in Proposition 3 we use Δq^{*--} instead of Δq^*.) Proposition 1 below applies to the case when (3.22) is satisfied, and Propositions 2 and 3 apply to the case when (3.23) is satisfied instead.

The rationale behind Propositions 1, 2 and 3 below is illustrated in Figure 1, which depicts the difference in the probabilities of success with high and low effort, $\pi_i(e_H, \Delta q, N^I, N^X) - \pi_i(e_i = e_L, e_j = e_H, \Delta q, N^I, N^X)$, for an insider. These probabilities are defined in (3.14) and (3.15) above. As the graph indicates, the incremental probability of success with effort is not monotonic in the size of the handicap. Note that when Δq is so negative that $\pi_i(e_H, \Delta q, N^I, N^X) = 0$, then $\pi_i(e_i = e_L, e_j = e_H, \Delta q, N^I, N^X) = 0$; that is, if the handicap on insiders is so large that one of the outsiders wins for sure when all insiders exert effort, then, one of the outsiders will have to win for sure when one insider shirks. Also if Δq is positive and increasing, then $\pi_i(e_H, \Delta q, N^I, N^X) - \pi_i(e_i = e_L, e_j = e_H, \Delta q, N^I, N^X)$ is decreasing. The rationale is that when Δq increases, the probability that an insider wins the contest becomes less dependent on effort. Indeed, for a handicap greater than that which precludes an outsider from winning the contest, the difference in probabilities becomes constant. Therefore, $\pi_i(e_H, \Delta q, N^I, N^X) - \pi_i(e_i = e_L, e_j = e_H, \Delta q, N^I, N^X)$ is null for a sufficiently large handicap on insiders, and it is weakly decreasing for a sufficiently large handicap on outsiders.

If the $t = 1$ prize to an insider CEO, $\bar{U}_1$, is sufficiently large as in (3.22), insiders are self-motivating (the incentive constraint is non-binding) and it does not cost the firm to provide incentives to them. Then, when insiders are good enough as in (3.20), the firm will handicap outsiders severely to facilitate the selection of insiders. In this case, which is Proposition 1, the handicap is $\Delta q^* > 0$ as shown in Figure 1. Here $\pi_i(e_H, \Delta q^*, N^I, N^X) - \pi_i(e_i = e_L, e_j = e_H, \Delta q^*, N^I, N^X)$ is relatively small, but the $t = 1$ prize is so large insiders motivate themselves to exert effort. By contrast, if the $t = 1$ prize is sufficiently small as in (3.23) (and insiders are good enough as in (3.20)), it does cost the firm to provide incentives, because the firm must reduce the handicap on less able outsiders, or even handicap the insiders. In this case, which is Proposition 2, the handicap is $\Delta q^{*\prime}$ and is shown as two possible points in Figure 1 depending on the relative ability of insiders. It is shown in Proposition 2 that a $\Delta q^{*\prime} > 0$ is optimal when insiders are sufficiently better than outsiders, and a smaller, possibly negative, $\Delta q^{*\prime}$ is optimal when insiders are only marginally better or they are marginally worse. Here the incentive constraint is binding because $\bar{U}_1$ is sufficiently small. As a consequence reducing the handicap on outsiders, which decreases the probability that a shirking insider wins by more than it decreases the probability that a non-shirking insider wins, is necessary to provide incentives to insiders to exert effort. Lastly if outsiders are sufficiently better as in (3.21), the cost of providing incentives outweighs the benefit and the firm will handicap insiders severely by choosing $\Delta q^{*--} < 0$ in order to facilitate the success of outsiders, which is Proposition 3.

Proposition 1 *If insiders are good enough so that condition (3.20) is satisfied, and if the $t = 1$ reservation utility of an insider CEO is sufficiently large relative to his incremental cost of effort in $t = 0$ so that condition (3.22) is satisfied, then the incentive compatibility constraints (3.11) of insiders are non-binding and outsiders are handicapped at the optimum, that is,*

$$\Delta q^* \geq 0. \tag{3.24}$$

where $\Delta q^* \geq 0$ satisfies

$$\frac{d\pi_i(e_H, \Delta q^*, N^I, N^X)}{d\Delta q} = 0, \tag{3.25}$$

at least when $(1 - S^{I*})e_H - (1 - S^{X*})E(e_x) + \bar{U}_1 > 0$. Therefore, in a related interior solution

$$\Delta q^* = (\bar{\varepsilon} - \underline{\varepsilon}) + (e_x(\bar{\alpha}) - e_H) + (\bar{\theta}^X - \underline{\theta}^I) + \varepsilon > 0, \tag{3.26}$$

with $\varepsilon > 0$, independently of the number of contestants N^X or N^I, so that

$$\pi_i(e_H, \Delta q, N^I, N^X) = \int_{\underline{\varepsilon}}^{\bar{\varepsilon}} (G(\varepsilon_i))^{N^I - 1} dG(\varepsilon_i) = \frac{1}{N^I}. \tag{3.27}$$

Proof Condition (3.20) implies that the firm benefits if insiders exert effort. Given condition (3.22), $\Delta q^* \geq 0$ automatically satisfies the incentive constraints, that is, the constraints are non-binding. The solution to the optimization problem without the incentive constraints (3.11), satisfies the Kuhn-Tucker condition:

$$[(1 - S^{I*})e_H - (1 - S^{X*})E(e_x) + \bar{\text{U}}_1]\frac{d\pi_i(e_H, \Delta q^*, N^I, N^X)}{d\Delta q}\Delta q^* = 0, \text{ with}$$

$$[(1 - S^{I*})e_H - (1 - S^{X*})E(e_x) + \bar{\text{U}}_1]\frac{d\pi_i(e_H, \Delta q^*, N^I, N^X)}{d\Delta q} \leq 0, \quad (3.28)$$

where

$$\frac{d\pi_i(e_H, \Delta q^*, N^I, N^X)}{d\Delta q} = N^X \int_{\underline{\varepsilon}}^{\bar{\varepsilon}} \int_{\underline{\theta}^I}^{\bar{\theta}^I} (G(\varepsilon_i))^{N^{I-1}} \left(\int_{\underline{\alpha}}^{\bar{\alpha}} \int_{\underline{\theta}^X}^{\bar{\theta}^X} G\left(\varepsilon_i + e_H - e_x(\alpha_x) + \theta^I - \theta^X + \Delta q^*\right) \times dH(\theta^X)dF(\alpha_x) \right)^{N^{X-1}}$$
$$\times \left(\int_{\underline{\alpha}}^{\bar{\alpha}} \int_{\underline{\theta}^X}^{\bar{\theta}^X} g\left(\varepsilon_i + e_H - e_x(\alpha_x) + \theta^I - \theta^X + \Delta q^*\right) \times dH(\theta^X)dF(\alpha_x) \right) dH(\theta^I)dG(\varepsilon_i). \quad (3.29)$$

(Note that the multiplier of the individual rationality constraint is equal to -1 by virtue of the Envelope theorem.) Given (3.28), and by noting that $d\pi_i(\cdot)/d\Delta q$ can only be non-negative, it follows that (3.25) is satisfied at least when $(1 - S^{I*})e_H - (1 - S^{X*})E(e_x) + \bar{\text{U}}_1 > 0$, so that the probability of success of an insider is maximized. Given (3.29), (3.25) can only be satisfied in an interior solution if Δq^* is such that

$$g(\varepsilon_i + e_H - e_x(\alpha_x) + \theta^I - \theta^X + \Delta q^*) = 0, \quad \forall \alpha_X, \theta^x, \varepsilon_i, \theta^I \quad (3.30)$$

Eq. (3.30) implies a handicap $\Delta q* > 0$ such that

$$g(\underline{\varepsilon} + e_H - e_x(\bar{\alpha}) + \underline{\theta}^I - \bar{\theta}^X + \Delta q^*) = g(\bar{\varepsilon} + \varepsilon) = 0, \quad (3.31)$$

with $\varepsilon > 0$. (Note that ε is not a random variable, but a small real number.) That is, the handicap drives the evaluation point at the smallest possible ε_i value, $\underline{\varepsilon}$, and at the smallest possible realization $e_H - e_x(\alpha_x) + \theta^I - \theta^X$, which is $e_H - e_x(\bar{\alpha}) + \underline{\theta}^I - \bar{\theta}^X$, to the upper tail of $g(\cdot)$ and right outside the support $[\underline{\varepsilon}, \bar{\varepsilon}]$ at $\bar{\varepsilon} + \varepsilon$, with $\varepsilon > 0$, which in turn implies (3.26). This handicap ensures that one of the insiders will win with probability one (i.e., the handicap is so large that it effectively excludes all outsiders regardless of ability), and the probability of winning by any given insider i who exerts effort is the maximum possible and satisfies (3.27). Equation (3.27) characterizes the probability that any given insider i's idiosyncratic shock is larger than that of all other insiders. □

Proposition 1 states that if the $t = 1$ reservation utility of an insider CEO is sufficiently large relative to his incremental cost of effort in $t = 0$, insiders motivate themselves to exert effort. Given that insiders are also better, the firm will maximize the probabilities of success of insiders by handicapping the outsiders severely at the optimum. Here, selection is all that matters and outsiders are handicapped so severely that they are prevented from winning the contest to become CEO. The same analysis holds if insiders are not much worse than outsiders, but in this case the firm trades a more able CEO in the future for a reduction in the current payment to insiders and higher insider effort. Note that, as shown by (3.26), the outsider handicap can increase with the range of outsider ability, as well as with the magnitude of the common shocks that affect output. The higher the maximum possible ability of outsiders and the larger the maximum possible shocks to their output, the more outsiders must be handicapped to maximize the probability of success by insiders. Next we analyze the case when insiders are still good enough, but where $\bar{U}_1$ is sufficiently small relative to $c(e_H) - c(e_L)$.

Proposition 2 *If insiders are good enough so that condition (3.20) is satisfied, and if the* $t = 1$ *reservation utility of an insider CEO is sufficiently small relative to his incremental cost of effort in* $t = 0$ *so that condition (3.23) is satisfied, then the incentive compatibility constraints (3.11) of insiders are binding and the optimum handicap satisfies*

$$\Delta q^{*\prime} > 0 \ \textit{or} \ = 0 \ \textit{or} \ 0. \tag{3.32}$$

In an interior solution, if insiders are sufficiently better than outsiders in the sense that expected $t = 1$ *profit from an insider CEO satisfies*

$$(1 - S^{I*})e_H > (1 - S^{X*})E(e_x) + \bar{U}_1, \tag{3.33}$$

then $\Delta q^{*\prime} > 0$ *satisfies*

$$\frac{d\pi_i(e_H, \Delta q^{*\prime}, N^I, N^X)}{d\Delta q} < \frac{d\pi_i(e_i = e_L, e_j = e_H, \Delta q^{*\prime}, N^I, N^X)}{d\Delta q}. \tag{3.34}$$

If insiders are only marginally better or are marginally worse than outsiders so that expected $t = 1$ *profit from an outsider CEO satisfies*

$$(1 - S^{X*})E(e_x) - \bar{U}_1 < (1 - S^{I*})e_H < (1 - S^{X*})E(e_x) + \bar{U}_1, \tag{3.35}$$

then $\Delta q^{*\prime} > 0$ *or* < 0 *satisfies*

$$\frac{d\pi_i(e_H, \Delta q^{*\prime}, N^I, N^X)}{d\Delta q} > \frac{d\pi_i(e_i = e_L, e_j = e_H, \Delta q^{*\prime}, N^I, N^X)}{d\Delta q}. \tag{3.36}$$

Proof Given condition (3.23), the solution to the optimization problem without the incentive constraints (3.11), Δq^*, violates the incentive constraints. However, given condition (3.20), the firm benefits by letting the incentive constraints be binding at the optimum so that insiders exert effort. Focusing on an interior solution

$\Delta q^{*\prime} > 0$ or < 0, the solution to the optimization problem with the incentive constraints (3.11) satisfies the condition:

$$[(1 - S^{I*})e_H - (1 - S^{X*})E(e_x) + \bar{\text{U}}_1]\frac{d\pi_i(e_H, \Delta q^{*\prime}, N^I, N^X)}{d\Delta q}$$
$$= -\mu^{*\prime}\bar{\text{U}}_1\frac{d\pi_i(e_i = e_L, e_j = e_H, \Delta q^{*\prime}, N^I, N^x)}{d\Delta q}, \tag{3.37}$$

where $\mu^{*\prime} < 0$ is the multiplier of the incentive compatibility constraint. Note that the multiplier of the individual rationality constraint plus $\mu^{*\prime}$ is equal to -1 by virtue of the Envelope theorem.

If insiders are sufficiently better than outsiders in the sense that expected $t = 1$ profit from an insider CEO satisfies

$$(1 - S^{I*})e_H - (1 - S^{X*})E(e_x) + \bar{\text{U}}_1 > -\mu^{*\prime}\bar{\text{U}}_1 > 0, \tag{3.38}$$

equivalently, if (3.33) is satisfied, then $\Delta q^{*\prime} > 0$ satisfies (3.34). If insiders are not sufficiently better than outsiders, that is, if they are only marginally better or they are marginally worse than outsiders so that expected $t = 1$ profit from an outsider CEO satisfies

$$0 < (1 - S^{I*})e_H - (1 - S^{X*})E(e_x) + \bar{\text{U}}_1 < -\mu^{*\prime}\bar{\text{U}}_1, \tag{3.39}$$

equivalently, if (3.35) is satisfied, then $\Delta q^{*\prime} > 0$ or < 0 satisfies (3.36).[11]

Lastly, to complete the proof, note that if outsiders are sufficiently better than insiders in the sense that expected $t = 1$ profit from an outsider CEO satisfies

$$(1 - S^{I*})e_H - (1 - S^{X*})E(e_x) + \bar{\text{U}}_1 < 0 < -\mu^{*\prime}\bar{\text{U}}_1, \tag{3.40}$$

then $\Delta q^{*\prime}$ would need to satisfy

$$\frac{d\pi_i(e_H, \Delta q^{*\prime}, N^I, N^X)}{d\Delta q} = \frac{d\pi_i(e_i = e_L, e_j = e_H, \Delta q^{*\prime}, N^I, N^X)}{d\Delta q} = 0, \tag{3.41}$$

that is, the probability of insider success with high effort would be maximized, $\pi_i(e_H, \Delta q^{*\prime}, N^I, N^X) = 1/N^I$, and that with low effort would be minimized, $\pi_i(e_L, \Delta q^{*\prime}, N^I, N^X) = 0$. However, this is a contradiction because no single Δq can simultaneously maximize the probability of success with high effort and minimize the probability of success with low effort. To maximize the probability of success with high effort, $\Delta q^{*\prime}$ would need to be positive and identical to Δq^* in Proposition 1. However, to minimize the probability of success with low effort,

[11] Note that both (3.38) and (3.39) automatically satisfy (3.20).

first note that

$$\frac{d\pi_i(e_i = e_L, e_j = e_H, \Delta q^{*\prime}, N^I, N^X)}{d\Delta q}$$

$$= N^X \int_{\underline{\varepsilon}}^{\bar{\varepsilon}} \int_{\underline{\theta}^I}^{\bar{\theta}^I} (G(\varepsilon_i + e_L - e_H))^{N^{I-1}} \left(\int_{\underline{\alpha}}^{\bar{\alpha}} \int_{\underline{\theta}^X}^{\bar{\theta}^X} G\left(\varepsilon_i + e_L - e_x(\alpha_x) + \theta^I \right.\right.$$

$$\left.\left. -\theta^X + \Delta q^{*\prime}\right) dH(\theta^X) dF(\alpha_x) \right)^{N^{X-1}}$$

$$\times \left(\int_{\underline{\alpha}}^{\bar{\alpha}} \int_{\underline{\theta}^X}^{\bar{\theta}^X} g\left(\varepsilon_i + e_L - e_x(\alpha_x) + \theta^I - \theta^X + \Delta q^{*\prime}\right) \right.$$

$$\left. \times\, dH(\theta^X) dF(\alpha_x)\right) dH(\theta^I) dG(\varepsilon_i). \tag{3.42}$$

Given (3.42), $d\pi_i(e_i = e_L, e_j = e_H, \Delta q^{*\prime}, N^I, N^X)/d\Delta q = 0$ can only be satisfied if $\Delta q^{*\prime}$ is such that

$$g(\varepsilon_i + e_L - e_x(\alpha_x) + \theta^I - \theta^X + \Delta q^{*\prime}) = 0, \forall \alpha_x, \theta^x, \varepsilon_i, \theta^I. \tag{3.43}$$

Condition (3.43) implies a handicap $\Delta q^{*\prime}$ such that

$$g\left(\bar{\varepsilon} + e_L - e_x\left(\underline{\alpha}\right) + \bar{\theta}^I - \underline{\theta}^X + \Delta q^{*\prime}\right) = g\left(\underline{\varepsilon} - \varepsilon\right) = 0, \tag{3.44}$$

with $\varepsilon > 0$. That is, the handicap drives the evaluation point at the largest possible ε_i value, $\bar{\varepsilon}$ and at the largest possible realization $e_L - e_x(\alpha_x) + \theta^I - \theta^X$, which is $e_L - e_x(\underline{\alpha}) + \bar{\theta}^I - \underline{\theta}^X$, to the lower tail of g(·) and right outside the support $[\underline{\varepsilon}, \bar{\varepsilon}]$ at $\underline{\varepsilon} - \varepsilon$, with $\varepsilon > 0$. This condition implies the optimum handicap

$$\Delta q^{*\prime} = (\underline{\varepsilon} - \bar{\varepsilon}) + (e_x(\underline{\alpha}) - e_L) + (\underline{\theta}^X - \bar{\theta}^I) - \varepsilon < 0, \tag{3.45}$$

with $\varepsilon > 0$, independently of the number of contestants N^X or N^I. Thus, any $\Delta q^{*\prime} > 0$ that maximizes the probability of success with high effort could not minimize the probability of success with low effort, because to achieve the latter would require $\Delta q^{*\prime} < 0$. □

Proposition 2 states that if the $t = 1$ reservation utility of an insider CEO is sufficiently small relative to his incremental cost of effort in $t = 0$, then, unlike Proposition 1, insiders need incentives from the firm to induce them to exert effort. Such incentives require that the handicap be reduced relative to that in Proposition 1 and may even require a negative handicap. This is because a smaller $t = 1$ prize makes the difference in the probabilities of success between exerting high effort and shirking that is necessary to provide incentives relatively larger. If the handicap increased over Δq^*, then $\pi_i\ (e_H, \Delta q, N^I, N^X)$ would not increase because it was already maximized with Δq^*. However, $\pi_i(e_i = e_L, e_j = e_H, \Delta q, N^I, N^X)$ would weakly increase, hence, $\pi_i(e_H, \Delta q, N^I, N^X) - \pi_i(e_i = e_L, e_j = e_H, \Delta q, N^I, N^X)$ would weakly decrease. Therefore the optimal handicap $\Delta q^{*\prime}$ must be less than Δq^*. Reducing the handicap decreases the probability that a shirking insider wins by more than it reduces the probability that an insider who exerts effort wins and, hence, provides correct incentives. Further when insiders are sufficiently better than outsiders, condition (3.34) implies a larger handicap on outsiders than that implied by condition (3.36) when insiders are only slightly better or they are marginally worse than outsiders. The reason why the handicap is larger for more able insiders than for less able insiders is as follows. Identical incentives can be provided either with a large positive handicap (such as the one corresponding to point A in Figure 1) or with a small, possibly negative handicap (such as the one corresponding to point B in Figure 1). To see this suppose for simplicity that the $\Delta q^{*\prime}$ that corresponds to point B is negative indeed (as in the figure). If the firm handicaps the outsiders, then, $\pi_i(e_H, \Delta q, N^I, N^X)$ increases more than $\pi_i(e_i = e_L, e_j = e_H, \Delta q, N^I, N^X)$. If the firm handicaps the insiders, then, $\pi_i(e_i = e_L, e_j = e_H, \Delta q, N^I, N^X)$ is reduced by more than $\pi_i(e_H, \Delta q, N^I, N^X)$. In both cases the firm will end up with the same difference $\pi_i(e_H, \Delta q, N^I, N^X) - \pi_i(e_i = e_L, e_j = e_H, \Delta q, N^I, N^X)$ and, hence, the same incentives. Given that the firm can provide the same incentives with a positive handicap corresponding to point A or a negative handicap corresponding to point B, the choice of optimal handicap will be dictated by the relative ability of insiders. When insiders are sufficiently better than outsiders, handicapping is larger at the optimum than if insiders are only marginally better or they are worse. Proposition 2 reflects the balance of forces between incentives and the selection of a more able CEO that is the heart of our analysis.

We now turn to the case when outsiders are sufficiently better than insiders so that (3.21) holds. Here, the firm will facilitate the selection of an outsider CEO by providing disincentives to insiders to exert effort, that is, $\Delta q^{*--} < 0$. Thus, our next proposition is.

Proposition 3 *If outsiders are sufficiently better than insiders so that condition (3.21) is satisfied, and if the $t = 1$ reservation utility of an insider CEO is sufficiently small relative to his incremental cost of effort in $t = 0$ so that condition (3.23) is satisfied, then the incentive compatibility constraints (3.11) of insiders are violated and insiders are handicapped at the optimum , that is,*

$$\Delta q^{*--} < 0, \tag{3.46}$$

where $\Delta q^{*--} < 0$, satisfies

$$\frac{d\pi_i(e_L, \Delta q^{*--}, N^I, N^X)}{d\Delta q} = 0 \tag{3.47}$$

therefore

$$\Delta q^{*--} = (\underline{\varepsilon} - \bar{\varepsilon}) + (e_x(\underline{\alpha}) - e_L) + (\underline{\theta}^X - \bar{\theta}^I) - \varepsilon < 0, \tag{3.48}$$

with $\varepsilon > 0$, independently of the number of contestants N^X or N^I, so that

$$\pi_i(e_L \Delta q^{*--}, N^I, N^X) = 0. \tag{3.49}$$

Proof Given condition (3.23), the solution to the optimization problem without the incentive constraints (3.11) violates the incentive constraints. However, given condition (3.21), the firm benefits by providing disincentives to insiders to exert effort, that is, by making the incentive constraints be violated through a negative handicap, $\Delta q^{*--} < 0$, at the optimum. The solution to the optimization problem without the incentive constraints (3.11), when the firm provides disincentives to the internal contestants, satisfies the condition:

$$[(1 - S^{I*})e_H - (1 - S^{X*})E(e_x) + \bar{\text{U}}_1]\frac{d\pi_i(e_L\Delta q^{*--}, N^I, N^X)}{d\Delta q} = 0. \tag{3.50}$$

(Note that the multiplier of the individual rationality constraint is equal to -1, again by virtue of the Envelope theorem.) It follows that (3.47) is satisfied so that the probability of success of an insider is minimized. Similar to the analysis in the proof of Proposition 2 above, (3.47) implies an insider handicap that satisfies (3.48) and a probability of success by any insider that is null as in (3.49). To complete the proof, note that it is not possible to set $\Delta q^{*--} < 0$ and automatically provide incentives to internal contestants to exert effort (i.e., to make the incentive constraint non-binding), because the probability of insider success would be null regardless of effort with Δq^{*--} (which would violate the incentive constraint). □

Proposition 3 again shows the tension between providing current incentives to insiders and selecting the most able CEO. Here, however, outsiders are so much better than insiders that insiders are handicapped severely so that the probability that one will be chosen CEO (win the contest) is minimized. The firm provides disincentives to insiders so that it can benefit from the greater likelihood of success by able outsiders. That is, the firm essentially eliminates insiders from the contest to become CEO. This leads insiders to not exert effort but it also eliminates the chance that a lucky insider will be picked to be CEO. Because outsiders are so much better than insiders, the trade-off is a good one for the firm. This finding is in sharp contrast to the existing literature on incentives and promotions.

3.3 Extensions

We consider three extensions which can be important for empirical applications. The first two focus on the common shocks faced by insiders, θ^I, and those faced by outsiders, θ^X. We begin by examining the effect on the optimal handicap if these two shocks become identical, that is, $\theta^I = \theta^X$. We then consider the effect on the optimal handicap if commonality among insiders (the importance of θ^I relative to idiosyncratic shocks) becomes greater. Finally, we examine the effect on the optimal handicap of allowing the firm to precommit to a large second period prize to an insider selected as CEO.

3.3.1 Common shocks the same for insiders and outsiders

In the analysis so far, the common shocks faced by insiders were treated as different from those faced by outsiders. How different are these two common shocks depends upon how heterogeneous are firms. Indeed, if all candidates for CEO come from firms that are subject to the same common shocks, so that $\theta^I = \theta^X$, the probabilities of success that are characterized in (3.14) and (3.15) become independent of these common shocks. As the common shocks faced by insiders become more similar to those faced by outsiders, luck becomes less important in determining the outcome of the contest to become CEO. When the link between common output shocks and the probability of success breaks down, the result is less handicapping. In the cases discussed in Propositions 1 and 2 where the firm benefits by handicapping outsiders, more similarity among the common shocks faced by insiders and those faced by outsiders implies that there is less chance for an insider to lose to an outsider due to unfavorable common shocks within the firm, hence, less handicapping of outsiders is needed to facilitate the success of insiders and provide incentives to them. Condition (3.26), in particular, reduces to

$$\Delta q^* = (\bar{\varepsilon} - \underline{\varepsilon}) + (e_x(\bar{\alpha}) - e_H) + \varepsilon > 0. \tag{3.51}$$

In the case discussed in Proposition 3 where the firm benefits by handicapping insiders the argument is symmetric.

In the case described in Proposition 2, there is an interesting empirical implication. Here, the reduction in the handicap imposed on outsiders also increases the likelihood that an outsider will be chosen CEO.[12] To the extent that most outside candidates to be CEO already work in the same industry, greater homogeneity within the industry means greater similarity between the common shocks faced by insiders and outsiders and so our model predicts a smaller handicap imposed on outsiders and a greater likelihood that outsiders will win the contest to become CEO. This is, in fact, what actually occurs as shown by Parrino (1997) and Agrawal et al. (2005).

3.3.2 Greater commonality among insiders

When the common shocks faced by insiders, θ^I, become larger relative to the idiosyncratic shocks, ε_i, the shocks faced by insiders become more alike. We characterize this as greater commonality among insiders. To examine the effect of this greater commonality on the handicap imposed on outsiders, we begin with the following definition.

Definition 1 *We say that there is greater commonality among the insiders in some firm A than among the insiders in some other firm B if $H^A(\theta^I)$ is first-order stochastically dominant over $H^B(\theta^I)$, and $G^B(\varepsilon_i)$ is first-order stochastically dominant over $G^A(\varepsilon_i)$.*

Thus, there is greater commonality in firm A than in firm B if $H^A(\theta^I) \leq H^B(\theta^I)$, for every θ^I, with strict inequality for a set of values of θ^I with positive probability, and $G^B(\varepsilon_i) \leq G^A(\varepsilon_i)$, for every ε_i, with strict inequality for a set of values of ε_i with positive probability.[13] In words, there is greater commonality in firm A than

[12] For the case in Proposition 1, the optimal handicap on outsiders is set so that an outsider cannot win the contest to become CEO. Where common shocks faced by insiders are identical to those faced by outsiders, this implies a smaller handicap as described in (3.51), but no increase in the likelihood that an outsider will be selected CEO.

[13] That is, if the likelihood of a realization at least as large as θ^I is higher under $H^A(\cdot)$ than under $H^B(\cdot)$, and the likelihood of a realization at least as large as ε_i is higher under $G^B(\cdot)$ than under $G^A(\cdot)$.

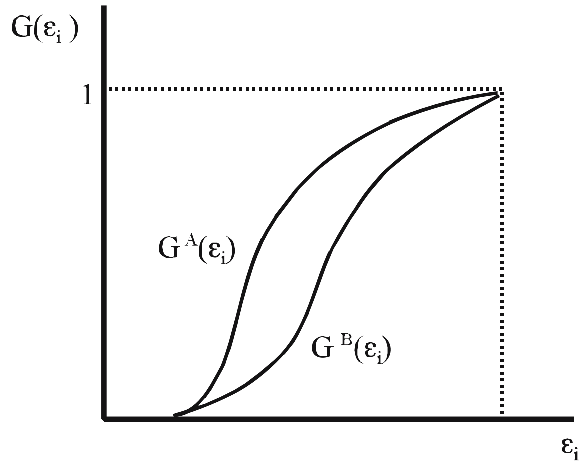

Fig. 2 Greater commonality in firm A

in firm B when it is more likely to obtain a greater common shock and less likely to obtain a larger idiosyncratic shock in firm A than in firm B.[14]

We argue that greater commonality could increase or decrease the optimal outsider handicap depending on the specific forms of the distribution functions $G^A(\varepsilon_i)$ and $G^B(\varepsilon_i)$, the level of effort to be implemented, e_H, and the incremental effort over shirking, $e_H - e_L$. To see the impact of greater commonality on the optimal outsider handicap, consider the incentive compatibility constraint (3.11) and the probabilities of success in (3.14) and (3.15), and note that the optimal handicap in the cases in which the incentive compatibility constraint is non-binding or violated at the optimum are not affected by the degree of commonality among insiders. Hence, we focus on the case in which the incentive compatibility constraint is binding.

An insider's probability of winning is the probability that he beats all other insiders times the probability that he beats all outsiders. The probability that he beats all outsiders is not affected by greater commonality within the firm when the total (common and idiosyncratic) risk is given, because all that matters for the probabilities of insider success in (3.14) and (3.15) is the additive effect of the common and idiosyncratic shocks ε_i and θ^I. Regarding the probability that an insider beats all other insiders, greater commonality in firm A than in firm B causes the distribution function $G^A(\varepsilon_i)$ to lie above that for firm B, and so the probability that some inside contestant beats some other insider is always larger in firm A than in firm B for the same amount of effort (see Fig. 2 for an example).[15] The intuition is that the chance of an insider losing to another insider due to bad luck (here, an unfavorable idiosyncratic shock) is reduced. Clearly, the optimal handicap depends on the difference in the probabilities of beating an insider while exerting effort, $G(\varepsilon_i)$, and that while

[14] Note that we can easily relax the assumption of zero means, which we made in Section 2, to accommodate differences in the extent of common uncertainty. Expected profit simply changes by a constant.

[15] The probability of beating an insider does not depend on θ^I since internal contestants are subject to the same common shock (see condition (2.1)).

shirking, $G(\varepsilon_i + e_L - e_H)$. Depending on the form of the distribution function $G(\varepsilon_i)$, the level of effort to be implemented, e_H, and the incremental effort over shirking, $e_H - e_L$, this difference can be larger or smaller for firm A than for firm B. That is, the difference between $\pi_i(e_H, \Delta q, N^I, N^X) and \pi_i(e_i = e_L, e_j = e_H, \Delta q, N^I, N^X)$ can increase or decrease with greater commonality. If the effort e_H to be implemented is sufficiently larger than effort when shirking, e_L, however, the probability of beating an insider while shirking (i.e., $G(\varepsilon_i + e_L - e_H)$, which is the probability that the idiosyncratic shock ε_i is smaller than a constant plus $e_H - e_L$) is only slightly larger in firm A than in firm B. (Pictorially, this is close to the origin of the distribution functions.) Because $\pi_i(e_i = e_L, e_j = e_H, \Delta q, N^I, N^X)$ is only slightly larger in firm A, but $\pi_i(e_H, \Delta q, N^I, N^X)$ is distinctly larger in firm A, the difference in the probabilities is greater in firm A than in firm B. Pictorially, the function $\pi_i(e_H, \Delta q, N^I, N^X) - \pi_i(e_i = e_L, e_j = e_H, \Delta q, N^I, N^X)$ in Figure 1 shifts up.[16] Since greater commonality increases this difference in the probabilities of success with high and low effort, the optimal handicap on outsiders rises for the same relative $\bar{U}_1$ value (provided that outsiders are handicapped because insiders are sufficiently better, and condition (3.34) applies).

Evidence in Agrawal et al. (2005) that firms organized by product (Chevrolet, Pontiac...) or line of business (chocolate, pasta...) are less likely to pick an outsider as CEO than firms organized along functional lines (finance, marketing...) is consistent with the conclusion obtained above. Executives in firms with product or line of business organizational structures perform more similar tasks and so would seem to face more similar common shocks than executives in firms with functional organizational structures.[17] And this greater commonality results in a smaller likelihood that an outsider is selected as CEO, suggesting a greater outsider handicap.

3.3.3 Precommiting to a profit share to a winning insider

Here we briefly extend our results to the case when the firm is able to precommit in $t = 0$ to a $t = 1$ prize (profit share). This flexibility may allow the firm to provide incentives to insiders to participate and to perform via the credible promise of an increased profit share to a winning insider, that is, it may affect the incentives the firm provides through handicaps.

In contrast to the no-precommitment case, the firm will choose a profit share for a CEO of internal origin, S^I, in $t = 0$, in addition to the $t = 0$ payment r_o and the handicap Δq. The optimum is the solution to the following program.

$$max_{r_o,\Delta q,S^I} N^I(e_i - r_o) + N^I\pi_i(e_i, \Delta q, N^I, N^X)(1 - S^I)e_H$$
$$+[1 - N^I\pi_i(e_i, \Delta q, N^I, N^X)](1 - S^{X^*})E(e_X)$$

subject to the individual rationality constraint

$$(r_o - c(e_i)) + \pi_i(e_i, \Delta q, N^I, N^X)(S^I e_H - c(e_H)) \geq \bar{U}_o, \forall i, \quad (3.52)$$

[16] As a result, the range of relative $\bar{U}_1$ values over which the incentive constraint is binding is smaller for firm A.

[17] Crémer (1980) examines the role of the organization as a reducer of uncertainty.

the $t = 0$ incentive compatibility constraint

$$[\pi_i(e_H, \Delta q, N^I, N^X) - \pi_i(e_i = e_L, e_j = e_H, \Delta q, N^I, N^X)]$$
$$(S^I e_H - c(e_H)) \geq c(e_H) - c(e_L), \forall i \tag{3.53}$$

the liquidity constraint (3.12), the $t = 1$ no-quit constraint

$$S^I e_H - c(e_H) \geq \bar{\text{U}}_1, \tag{3.54}$$

and the $t = 1$ incentive compatibility constraint

$$(S^I e_H - c(e_H) \geq (S^I e_L - c(e_L), \tag{3.55}$$

where $E(e_x)$ was defined in (3.13).

Similar to the no-precommitment case discussed in Section 3.2, observe that the incentive compatibility constraint is independent of the $t = 0$ payment r_o; whereas r_o is important for agent participation, it is the prize S^I and the handicap Δq that are the critical factors for agent incentives to perform. In contrast to the no-precommitment case, the firm now has flexibility in selecting S^I in $t = 0$. This improved flexibility may affect handicapping at the optimum.

To provide maximum incentives to insiders to perform through a big prize, the firm can in principle minimize the $t = 0$ payment and maximize the value of the prize, that is, the firm can set

$$r_o^{**} = 0 \tag{3.56}$$

and

$$S^{I**} = \frac{\bar{\text{U}}_o + (1 + \pi_i(e_H, \Delta q^{**}, N^I, N^X))c(e_H)}{e_H \pi_i(e_H, \Delta q^{**}, N^I, N^X)}, \tag{3.57}$$

provided that the profit share S^{I**} does not exceed 1. Note that $S^{I^{**}}$, which satisfies the individual rationality constraint (3.52) with equality, also satisfies

$$S^{I^{**}} > S^{I*} = \frac{\bar{\text{U}}_1 + c(e_H)}{e_H}.^{18} \tag{3.58}$$

The right-hand side of (3.58) states that S^{I*} provides no $t = 1$ rents. Thus, S^{I**}, which is larger, provides $t = 1$ rents (hence, both (3.54) and (3.55) are non-binding), even though $S^{I^{**}}$ does not provide *ex ante* ($t = 0$) rents. Since $S^{I^{**}}$ provides $t = 1$ rents, it can only survive if the firm can precommit in $t = 0$, otherwise the firm would revise its initial $t = 0$ offer in $t = 1$ to the smaller $S^{I^{*}}$, and the agent would have to accept it and receive no rents.

Whether the firm prefers to offer a bigger prize (i.e., a prize as big as $S^{I^{**}}$) to provide incentives to insiders depends on the ability of the contestants. If insiders are good enough, observe that increasing the prize may slacken the incentive constraint. If it does, then the handicap on outsiders increases, which can be consistent with profit maximization because insiders are good enough (that is, the

[18] The proof follows from the regularity assumption $\bar{\text{U}}_o + c(e_L) > \bar{\text{U}}_1$.

firm may exercise the power to precommit at the optimum). If the incentive constraint is still binding, then the increase in the $t = 1$ prize above an insider's reservation utility implies that a smaller difference in the probabilities of success, $\pi_i(e_H, \Delta q, N^I, N^X) - \pi_i(e_i = e_L, e_j = e_H, \Delta q, N^I, N^X)$, than the one without precommitment provides correct incentives. Pictorially, this is a movement down the curve in Figure 1. Here there are two possibilities. If insiders are sufficiently better than outsiders, point A in Figure 1 is relevant and precommitment, again, raises the handicap on outsiders. The intuition is that because insiders are provided with incentives to perform via a higher profit share, there is no need to reduce the handicap on outsiders in order to provide disincentives to shirking insiders (which was the case without precommitment). Here also precommitment can have value because it allows for an increase in the handicap on less able outsiders. If insiders are marginally better or marginally worse than outsiders, point B in Figure 1 is relevant and precommitment reduces the handicap on outsiders or raises the handicap on insiders (whichever case was previously optimal). In this case, interestingly, firms that can precommit become less loyal to their employees, which can be consistent with profit maximization though because insiders are only marginally better or they are marginally worse than outsiders. Lastly, when outsiders are sufficiently superior, for the same severe handicap on insiders that was optimal without precommitment, internal contestants may now have incentives to exert effort if the increase in the $t = 1$ profit share with precommitment is large enough. Note that the firm would never find it optimal to reduce the handicap on inferior insiders, however, the firm might find it optimal to increase the handicap on insiders so that their probability of success when they exert effort is reduced. Thus, precommitment may allow the firm to benefit by increasing the handicap on inferior insiders who, nonetheless, exert effort competing to be CEO.

4 Conclusion

A new CEO can be viewed as the winner in a contest to become CEO. We model such contests as providing incentives to insiders (candidates seeking promotion) in the current period and as selecting the CEO for the next period. Both functions matter. Current incentives affect firm profits now and the ability of the new CEO affects firm profits in the future. This creates a trade-off between providing incentives to current employees and selecting the most able to become CEO. We examine the role of handicaps imposed on outsiders or on insiders in light of this trade-off.

If insiders are better than outsiders and if the pay as CEO (the prize) is high relative to the incremental cost of exerting effort in the contest to become CEO, it is unnecessary to provide extra incentive to insiders. Here, selection is all that matters and outsiders are handicapped so severely that they are prevented from winning the contest to become CEO. The same is true if insiders are not much worse than outsiders. But now the firm trades a more able CEO in the future for a reduction in the current payment to insiders and higher insider effort. If insiders are better or not much worse than outsiders, but pay as CEO is low relative to the incremental cost of effort, extra incentives are necessary to induce insider effort. These incentives are provided by lowering the handicap on outsiders in order to reduce the probability that a shirking insider will win the contest to become CEO, and may even require a handicap on insiders depending on the relative ability of insiders. Further, if outsiders are sufficiently better than insiders, incentives will be sacrificed for selection and it is insiders who will be so severely handicapped that they cannot win the contest to become CEO. We extend the analysis by allowing the firm to credibly precommit to paying more than an insider CEO's reservation utility. Although the firm may not always find it beneficial to precommit, when it does so it will typically raise the handicap on outsiders.

These results provide useful insight into contests to become CEO and provide a framework for understanding cross-firm patterns in the likelihood of selecting an outsider as CEO. In particular, extensions of the analysis help to explain the lower tendency of firms in more heterogeneous industries and firms with a product or line of business organizational structure to select an outsider as CEO.

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