Queen's Economics Department Working Paper No. 1110

Managerial Capital and the Market for CEOs

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10-2006

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October 2006

Abstract

This paper reconciles two pronounced trends in U.S. corporate governance: the increase in pay levels for top executives, and the increasing prevalence of appointing CEOs through external hiring rather than internal promotions. We propose that these trends reflect a shift in the relative importance of "managerial ability" (transferable across companies) and "firm-specific human capital" (valuable only within the organization). We show that if the supply of workers in the corporate sector is relatively elastic, an increase in the relative importance of managerial ability leads to fewer promotions, more external hires, and an increase in equilibrium average wages for CEOs. We test our model using CEO pay and turnover data from 1970 to 2000. We show that CEO compensation is higher for CEOs hired from outside their firm, and for CEOs in industries where outside hiring is prevalent.

* We would like to thank George Baker, Nancy Beaulieu, Ken Binmore, Luis Garicano, Bob Gibbons, Paul Grout, Charles Himmelberg, Bengt Holmstrom, Meg Meyer, Hodaka Morita, and Mike Waldman for helpful comments and suggestions. Both authors gratefully acknowledge the financial support provided by the USC Marshall School.

Managerial Capital and the Market for CEOs

by

Kevin J. Murphy and Ján Zábojník

1. Introduction

Executive compensation has increased dramatically over the past three decades. Although much of the increase coincides with an escalation in the use of executive stock options (Hall and Murphy, 2000, 2003), the base salaries and bonuses of *Forbes 800* chief executive officers (CEOs) tripled over this time period, increasing from an average of $700,000 in 1970 (in 2002-constant dollars) to over $2.2 million in 2000.[1] As illustrated in Figure 1, the ratio of CEO pay to average pay for production workers also tripled over these three decades: the average CEO made just over 20 times more than the average production worker in 1970, and nearly 90 times more by 2000.[2]

An equally pronounced, but less analyzed trend in U.S. corporate governance is the increasing prevalence of filling chief executive officer (CEO) openings through external hires rather than through internal promotions. Figure 2 shows the relative frequency of external vs. internal CEO replacements for companies in the annual *Forbes* surveys from 1970 through 2000.[3] During the 1970s and 1980s, outside hires accounted for 15% and 17% of all CEO replacements, respectively. In contrast, during the 1990s (and through 2000) more than one in four CEOs were hired from outside the company.

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1 The *Forbes 800* consists of companies in the top 500 ranked by revenues, income, assets, and market capitalization (on average, about 800 firms are ranked in the top 500 by at least one of these criterion).

2 Production worker pay calculated as 52*(avg. weekly hours of production workers)*(avg. hourly earnings of production workers), based on data from the Current Employment Statistics, Bureau of Labor Statistics.

3 Executives serving in their firm for less than a year before the CEO appointment are considered external hires, while those employed for more than a year are considered inside hires. Data are based on 2,873 newly appointed CEOs from 1,323 companies.

In this paper, we develop and test a model that reconciles the trends in CEO pay levels and outside hirings. We propose that these trends reflect a shift in the relative importance of general and specific "managerial capital" (human capital specific to managerial positions). In particular, we distinguish between "general managerial ability" (managerial skills valuable across companies, including financial and accounting expertise and the ability to manage human and physical assets) and "firm-specific managerial capital" (reflecting skills, knowledge, contacts, and experience valuable only within the organization). [4]

We conjecture that over the past three decades, the society has steadily accumulated a body of knowledge in economics, management science, accounting, finance, and other disciplines, which, if mastered by a CEO, can substantially improve his ability to manage any modern corporation successfully. In addition, most information became available in computerized form at the tip of the manager's (or his assistant's) fingers.[5] While this is true for general and specific information alike, we find it plausible that computerization is more helpful in the case of concrete, firm-specific information about a company's operation, like information about its product markets, its suppliers and clients, etc., than in the case of general knowledge. Computers allow for easy access, sorting, and analysis of specific information; it may therefore be less important that a present day CEO candidate spends an extended period of time in the company acquiring firm-specific knowledge. On the other hand, it is not much of an improvement if a manager can read about, say, the concept of strategic commitment from a computer monitor rather than from a textbook, and the

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[4] Lazear (2003) has recently argued that a more informative view of firm-specific human capital is that each job requires a slightly different combination of a multiplicity of general skills. Our hypothesis that a relatively small set of general skills, acquired through the study of economics, accounting, finance, and related disciplines, are becoming more important for any senior managerial job, is consistent with this skill-weights approach to specific-human capital.

[5] Focusing on recent changes in wage inequality, Garicano and Rossi-Hansberg (2003 and 2004) have put forward a related argument, positing that these changes are to a large extent driven by advances in communicating and processing knowledge and information. They develop an elegant framework for formalizing the effects of communication costs within organizations on the size distribution of hierarchies and on the distribution of wages.

information is not going to be of much use to the manager anyway unless he masters related pieces of general knowledge, such as the basic principles of economics and game theory.

In our model, the importance of the general relative to firm-specific component of managerial capital leads to fewer promotions, more external hires, and an increase in equilibrium average wages for CEOs. Underlying our analysis is the idea that, due to competition among potential employers in the managerial labor market, the CEOs can capture the whole marginal product created by their transferable ability, but the lack of alternative use for their firm-specific skills means that they can only extract a fraction of the rents created by this part of their human capital. Therefore, a shift in the relative importance of general managerial ability will lead to higher wages even if overall managerial marginal productivity declines.[6] The associated wage increase will be especially pronounced for the highest-ability managers, as competition for the most-talented managers becomes more intense.

Our approach offers new interpretations for both the increase in CEO pay levels and outside replacements. Bebchuk, Fried, and Walker (2002) have argued that the escalation in pay reflects that pay levels are determined not by competitive market forces but rather by captive board members catering to rent-seeking entrenched managers. Under our approach, the increase in pay (coupled with the trend in external hires) is not only consistent with competition, but is evidence that the market for CEOs is becoming more important in determining CEO pay levels.[7] Both Huson, Parrino, and Starks (2001) and Hermalin (2003) have suggested that the trend in outside hiring reflects greater board diligence in monitoring the CEO. Our approach does not require increased board vigilance, and is consistent with our

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[6] Himmelberg and Hubbard (2000) argue that increased CEO pay levels reflect increased managerial productivity (which they propose is correlated with aggregate stock-market shocks); we predict higher wages without assuming increased productivity.

[7] Our interpretation is consistent with Bebchuk-Fried-Walker in one respect: the increase in the relative importance of transferable ability will allow CEOs to capture a larger share of the rents, as firms compete for scarce managerial talent.

results that the trend towards outside hiring is not driven by companies replacing poorly performing CEOs.[8]

We begin in Section 2 by developing a partial-equilibrium model of one firm's choice between filling a CEO vacancy with an internal or external candidate. As in our companion paper (Murphy and Zábojník, 2004), which contained a rudimentary version of the present framework, we model the CEO external-internal hiring choice as a trade-off between matching and firm-specific skills. When a company hires from outside, it foregoes valuable specific skills available only through internal promotions, but is able to hire from a larger opportunity set of managers which, in turn, allows better matching of managers and firms. As firm-specific capital becomes relatively less important, the benefit of better matching becomes large relative to the cost of (lost) specific capital, and the prevalence of outside hires will increase. Competition in the external labor market allows CEOs hired from the outside (without firm-specific capital) to capture all the rents through higher wages. Increasing the importance of the fully priced component of managerial productivity (transferable ability) relative to the partially priced component (specific capital) results in higher equilibrium wages, especially for the highest-ability managers.

In Section 3, we develop a market equilibrium model of managerial production and hiring decisions. Specifically, we allow for the firm productivity to depend upon the number of firms in the industry and we let the shift in the importance of general managerial ability to affect the equilibrium wages of workers. We show that our basic results from Section 2 hold in the market-equilibrium setting when the market supply of workers is sufficiently elastic.

Section 4 offers several extensions to the model. First, we allow individuals to choose their skill composition and show that individuals will invest more in general managerial skills (e.g., obtain MBA degrees) as the importance of the general skills increases. Second, we extend our model to boards of directors, in which the skills needed to effectively

[8] See Mikkelson and Partch (1997), Murphy (1999), and our updated analysis in Section 5 below.

represent the interests of shareholders depend upon the composition of managerial skills needed to run the company. We show that a decrease in the specificity of managerial skills will trigger a change in the board's optimal composition; in particular, there will be a shift towards more outside directors and fewer inside directors, consistent with the trend observed in recent decades (Hermalin and Weisbach, 1988; Borokhovich, Parrino, and Trapani, 1996).

Section 5 considers alternative explanations for both the increase in pay levels and the shift towards external hires, and offers empirical evidence consistent with the managerial-capital approach. We show that the increase in CEO pay has coincided with an increase in CEOs holding MBA degrees (which we use as a rough proxy for transferable managerial ability) and a decrease in firm-specific experience (which we use as a rough proxy for non-transferable specific capital). In addition, we show that CEOs hired from the outside earn a premium relative to those promoted internally, and CEOs in industries with higher prevalence of external hirings earn more than CEOs in other industries. Taken together, these results are consistent with the Bebchuk-Fried-Walker hypothesis that CEOs are extracting a larger share of the rents than in the past, but inconsistent with their view that these increased rents reflect the influence of powerful incumbent executives over captive boards. Finally, we document that the increase in external hirings is not explained by boards going outside to replace poorly performing incumbents.

Section 6 concludes and offers directions for future research. In particular, while we offer convincing circumstantial evidence consistent with a shift in the importance of managerial ability relative to firm-specific capital, we do not currently incorporate direct proxies for this shift into our empirical tests of the effect of managerial capital on the market for CEOs. All formal proofs are in the Appendix.

2. A partial-equilibrium model

In order to motivate our analysis and develop the underlying intuition, we begin with a simple partial-equilibrium model of one firm's choice between filling a CEO vacancy with an internal or external candidate. To expedite the analysis, we make here several simplifying assumptions about the market for workers and managers; most notably, (i) we assume that the incumbent managers who become CEOs do not capture *any* of the surplus generated by their firm-specific human capital, (ii) we abstract from the effects of new entry on the incumbent firms' profitability, and (iii) we treat the wages of workers' as exogenously fixed. We relax all of these assumptions, and provide a more formal and complete description of the economic environment, in our general-equilibrium model in Section 3.

We assume that firms consist of workers and one CEO, and that they produce output by combining labor with the CEO's managerial ability, a. In particular, a firm employing n workers produces $f(n)sa$ units of output. The function $f(n)$ is increasing, concave and continuously differentiable, and satisfies $f(0) = 0$, $f'(0) = \infty$, and $\lim_{n\to\infty} f'(n) = 0$. The variable s captures the level of the CEO's firm-specific knowledge: if the CEO is promoted internally, then $s = 1$, while if the firm hires an external candidate with no firm-specific knowledge, then $s = \gamma < 1$. Note that the lower is γ, the greater is the relative importance of the firm-specific skills for a CEO's productivity. Note also that our assumption that if the CEO switches firms he loses the firm specific part of his human capital extends to the cases where the CEO starts his own firm. Such a new firm requires new employees whose abilities and competencies the CEO has to learn. Moreover, since trade secrets laws may prevent the CEO from taking with him the old employer's client list, the new firm may be forced to develop new clients whose needs the CEO must learn. Similarly, he may have to create relationships with new suppliers, new investors, and so on.

Denote by $w^M(a)$ the market wage for a manager/CEO of ability a and by w the market wage for workers. The profit of a firm with n workers and a CEO of ability a can then be written as

$$\pi(n,a,s) = f(n)sa - wn - w^M(a). \quad (1)$$

Basic trade-off. Suppose now that a firm with n workers has a CEO vacancy and a (single) internal candidate for the position, whose ability is $\hat{a}$. This firm faces a "make or buy" tradeoff. First, it can promote the internal candidate, in which case its profit is

$$\pi(n,\hat{a},1) = f(n)\hat{a} - wn - w^M(\hat{a}),$$

thereby preserving firm-specific managerial capital $(1-\gamma)\hat{a}$. Alternatively, the firm can fill the CEO position by hiring from the outside market for managers (which we assume contains a sufficient supply of CEOs at each ability level $a \in R^+$). The firm hiring from the outside forgoes the firm-specific capital, but can pick the candidate who is the best fit for its size, that is, the one with ability a^* such that

$$a^* \equiv \arg\max_a \left(f(n)\gamma a - wn - w^M(a) \right).$$

In this case, the firm's profit is given by

$$\pi(n,a^*,\gamma) = f(n)\gamma a^* - wn - w^M(a^*).$$

Clearly, the firm promotes the internal candidate if the $\pi(n,\hat{a},1) \geq \pi(n,a^*,\gamma)$ and hires from the outside market if the reverse is true.

CEO wages. We assume that there is free entry of firms at any firm size. Therefore, any CEO of ability a can find a firm of size $n^*(a)$ that is the best match for his ability level:

$$n^*(a) \equiv \arg\max_n \left(f(n)\gamma a - wn \right). \quad (2)$$

Thus, a CEO of ability a must be paid at least $\psi(a) \equiv f(n^*(a))\gamma a - wn^*(a)$. Note that the market wage function $\psi(a)$ is increasing and convex in a, and that larger firms are optimally

managed by higher-ability CEOs, as in Rosen (1982) and Waldman (1984).[9] Since each CEO can instead choose to work in a non-managerial position at wage w, the equilibrium wage of a CEO of ability a is determined as

$$w^M(a,\gamma) = max\{w, \psi(a)\} \equiv max\{w, f(n^*(a))\gamma a - w(n^*(a))\}. \quad (3)$$

Figure 3 illustrates how the market wage for CEOs varies with managerial ability for a given level of γ. Managers with ability $a < \bar{a}$ and all workers earn wage w, while managers with ability $a \geq \bar{a}$ earn $\psi(a)$, where $\bar{a}$ is given by

$$f(n^*(\bar{a}))\gamma\bar{a} - w(n^*(\bar{a})) \equiv w. \quad (4)$$

Firms' optimal promotion strategy. Due to free entry of firms, the companies that fill their CEO positions with external hires earn at most zero profits in equilibrium. When the optimal managerial ability for a firm with size n is $a^* > \bar{a}$, then they earn exactly zero profit: substituting $w^M(a) = \psi(a^*)$ into $\pi(n,a^*,\gamma)$ yields

$$\pi(n,a^*,\gamma) = f(n)\gamma a^* - wn - \psi(a^*) = 0.$$

When $a^* < \bar{a}$, the profit from outside hiring is negative, $\pi(n,a^*,\gamma) < 0$, because the CEO earns $w > \psi(a^*)$. In this case the firm either promotes the internal candidate or exits the market. Thus, if a firm does not promote its internal candidate, it will either hire an outside CEO who is the best match for it or exit, in either case earning zero profit. The optimal promotion strategy of a firm whose internal candidate has ability $\hat{a}$ is to promote this candidate if $\pi(n,\hat{a},1) \geq 0$, that is, if

$$f(n)\hat{a} - wn \geq w^M(\hat{a}), \quad (5)$$

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[9] The latter claim follows because $n^{*\prime}(a) = \frac{-f'}{af''} > 0$.

and hire from the outside otherwise. Note that inequality (5) can never hold if n is too small. We will therefore restrict our attention to firms that are sufficiently large, so that (5) can be satisfied at least for some internal candidates. Then, as Figure 4 illustrates, the fact that the firm's profit gross of the manager's wages, $f(n)\hat{a} - wn$, is linear and increasing in $\hat{a}$, while the CEO's wage $w^M(\hat{a})$ is non-decreasing and convex, means that inequality (5) holds if and only if the internal candidate's ability falls within an interval $[a_L(n), a_H(n)]$, where $a_L(n) \geq 0$ and $a_H(n) > \bar{a}$. Thus, the company will find it optimal to fill the CEO position internally if and only if the internal candidate's ability, $\hat{a}$, is sufficiently close to the company's perfect fit, a^*.

As discussed earlier, the profit from hiring an external candidate is negative when $a^*(n) < \bar{a}$. This means that if $\hat{a} < a_L$ while at the same time $a^*(n) < \bar{a}$, the firm's profit maximizing strategy is to exit the market. Consequently, small firms never hire their CEOs in the external market in our model – either their internal candidate turns out to have sufficiently high managerial skills, or they go out of business.[10] This feature of our model is consistent with existing empirical evidence suggesting that small firms are more likely to go bankrupt than large firms (e.g., Brown, Hamilton, and Medoff, 1990, p. 21).

Model's implications. Our basic premise is that over the past several decades, the general managerial skills have become more important relative to firm-specific knowledge. In our model, this shift is represented by an increase in γ from some initial γ_L to some $\gamma_H > \gamma_L$, as illustrated in Figure 5 (for the specific firm that we depict, a_L is smaller than $\bar{a}$, although for larger firms the relationship is reversed). The figure conveys three interesting implications of this change:

- First, consistent with the trend in executive compensation documented in Figure 1, the increase in γ brings about an increase in the absolute and relative CEO market wages.

[10] Formally, this claim applies to those firms for which $n < \bar{n}$, where $\bar{n}$ is given by $a^*(\bar{n}) = \bar{a}$. Because $a^*(n)$ decreases in n, $a^*(n) < \bar{a}$ for all such firms.

Graphically, this is represented as an upwards shift in the CEO wage curve, from $\psi(\gamma_L) = f(n^*)\gamma_L a - wn^*$ to $\psi(\gamma_H) = f(n^*)\gamma_H a - wn^*$.

- Second, the increase in managerial market wages means that more workers decide to become managers (perhaps in their own firms), which is reflected in the decrease in the cutoff ability level $\bar{a}$.
- Finally, in accord with the trend documented in Figure 2, the propensity of firms to hire their CEOs from the outside increases. The reason is that while they have to get the same wages, an increase in γ decreases the gap between the respective productivities of the internal and external candidates of the same ability, because the internal candidates' productivity (given by the line $f(N)a - wN$) does not depend on γ. This conclusion can be seen in Figure 5 from the fact that a_H decreases. (In the figure, a_L stays the same because w is unaffected by a change in γ in the present partial equilibrium setting. However, for large firm sizes a_L is greater than $\bar{a}$, in which case a_L increases with γ. This reinforces our conclusion that the probability of internal promotion decreases as managerial skills become less specific.)

3. The market-equilibrium framework

In this section, we fill in further details regarding the market environment in which the firms and the agents operate. We also complete the analysis by incorporating the effects of an increase in γ on the equilibrium market wage w and by allowing the newly entering firms to affect the incumbent firms' profitability. We show here that the straightforward comparative statics effects described in the previous section become somewhat more complicated when a change in the equilibrium worker wage is taken into account, because an increase in γ brings about an increase in w, which tends to offset the effects we have just described. Nevertheless, it will turn out that the basic economic intuition developed earlier continues to hold in the

market equilibrium setting, although some of the results will require a sufficiently elastic supply of workers.

In addition to allowing for endogenous determination of firm profitability and for changes in γ to affect the equilibrium market wage w, we also relax our earlier assumption that the firm captures the entire surplus generated by the CEOs' firm-specific capital. In particular, we allow incumbent managers who become CEOs to extract part of the rents from their firm-specific capital, and show that our results are not affected (so long as the CEO does not capture the *whole* surplus).

FIRMS AND WORKERS. Consider a two-period economy with measure one of workers born at t = 1, which is the beginning of the first period. The workers in the first period of their working life will be termed as young, the second period workers will be referred to as old or experienced workers. For simplicity, young workers will be assumed to be liquidity constrained, so that their wages cannot be negative.

The economy consists of two sectors: a corporate sector, which will be the focus of our analysis, and a self-employment sector. It is the mobility of workers between these two sectors that makes both the workers' wages and the firms' profitability endogenously determined in equilibrium. The productivity of a young worker employed in either sector is zero. Each old worker in the self-employment sector produces and earns $\varphi(\kappa m)$, where $\varphi(.) : \Re^+ \to \Re^+$ is a decreasing, concave and differentiable function, m is the measure (determined endogenously in equilibrium) of old workers employed in this sector, and κ is a parameter that will allow us to vary the elasticity of labor supply in the corporate sector.

The corporate sector consists of firms, each of them characterized by the number of workers, n, that it employs in a given period. At t = 1, there is a measure $\nu < 1$ of existing firms in the corporate sector, whose sizes are drawn from a set $S \subset \Re^+$, according to a cumulative distribution $H(n)$. Thus, $\nu = \int_S dH(n)$.

At t = 2, there is free entry at any firm size $n \in \Re^+$. Also, at this time any existing firm can adjust its level of employment from *n* to *n'* by exiting and re-entering at a new size, *n'*. Each corporate sector firm has one CEO position and one position in which it can train a young worker for the CEO job. The supply of non-managerial workers in the second period depends upon their wage, *w* — the higher is this wage, the higher is the number of workers that choose the corporate sector over the self-employment sector.

WORKERS' SKILLS. Old workers differ according to their managerial ability, *a*, accumulated during the first period of their employment. The underlying distribution of ability *a* in the population is given by a cumulative distribution function *G(a)*, with support $\Re^+$. If a worker did not work in the corporate sector when young, then he does not posses the managerial skill when old, i.e., $a = 0$ for this worker.

As in Section 2, a worker's managerial ability only affects his productivity if assigned to the CEO position. Again, a fraction $1-\gamma$ of a worker's ability is a firm-specific skill, and is developed only by the workers placed in the trainee position when young. This skill is not transferable across firms — if a worker with a firm-specific managerial training changes his employer after the first period, or if the worker's first-period employer adjusts its size at the beginning of the second period by exiting and re-entering at a different size, this skill is lost.

PRODUCTION TECHNOLOGY IN THE CORPORATE SECTOR AND RENT EXTRACTION. If all CEOs received their market wages, the profit of a firm of size *n* would be $\pi(n,a,s)$ as given by (1) in the previous section. To allow for the possibility that CEOs extract additional rents from their firms, we will assume that if $\pi(n,a,s)$ is positive, then in addition to his market wage $w^M(a,\gamma)$, the firm's CEO captures a share $\rho \in (0,1)$ of $\pi(n,a,s)$ as a rent. The rent of a CEO of ability *a*, employed by a firm of size *n*, can therefore be written as

$$R(n,a,s) = \max\{0, \rho\pi(n,a,s)\},$$

and his total pay is $P(n,a,\gamma) = w^M(a,\gamma) + R(n,a,s)$.

The profit of the firm, taking into account the rent extraction by the incumbent manager promoted to CEO, is $(1-\rho)(f(n)sa - wn - w^M(a))$ if profit is positive, and $f(n)sa - wn - w^M(a)$ if profit is negative. Note that no firm would find it optimal to promote to the CEO position a worker who was not employed in the corporate sector when young, because $a = 0$ for such workers.

WAGE OFFERS AND JOB ASSIGNMENTS. At the beginning of the second period (which will be the focus of our analysis), firms observe the ability a of every old worker in the corporate sector. Each existing firm then either promotes its CEO trainee, or hires a new CEO from the market.[11] In addition, we allow existing firms to decide upon their optimal size, n, and new firms to enter. Next, all firms make simultaneous job offers and wage bids to all workers in the economy. After that, each worker decides which offer to accept. Workers that do not like any of their job offers can go and start their own firms.

3.1 The Analysis

We have assumed that the young workers are not productive in either sector. However, being employed in the corporate sector has an option value, due to the possibility of becoming a CEO. Therefore, all young workers will seek employment in the corporate sector, which will drive their equilibrium wages to zero. However, our main interest lies in deriving the equilibrium pay of old workers in both the CEO and non-CEO positions, as well as the equilibrium level of CEO turnover. The goal of our analysis is to use these results to

[11] Conceptually, the company could promote a non-trainee current employee rather than external hire. In our model there is no advantage to doing so and one large disadvantage: the probability of finding a perfect "match" among current employees is trivially small.

examine the effects of a change in the relative importance of general skills on both the absolute and relative levels of CEO compensation and on the proclivity of firms to hire outside CEOs.

In the previous section, we have shown that an established firm of size n will promote its internal trainee if and only if the trainee's ability is between the cutoff levels $a_L(n)$ and $a_H(n)$. Note that a_L can be either smaller or greater than $\bar{a}$. In the subsequent analysis, we will sometimes need to distinguish between these two cases. We will therefore write a_{L1} when n is such that $a_L \leq \bar{a}$, and the set of firm sizes such that $a_L = a_{L1}$ will be denoted as S_1, i.e., $S_1 = \{n \in S \mid a_L(n) \leq \bar{a}\}$. Similarly, we will write a_{L2} when $a_L > \bar{a}$, and denote the corresponding set of n as S_2, i.e., $S_2 = \{n \in S \mid a_L(n) > \bar{a}\}$. We will keep using a_L when this distinction is not important.

If the internal trainee's ability is a_{L1}, so that his market wage is w, then promoting this candidate must yield zero profit, because by definition of a_{L1} the firm is indifferent between promoting the trainee and hiring an outside CEO, which yields zero profit. The cut-off ability a_{L1} is therefore given by

$$f(n)a_{L1} - wn = w. \tag{6}$$

Note that given that $\pi(n,a,s) = 0$ when condition (6) holds, the cut-off level a_{L1} is independent of the rent-extraction parameter ρ.

In a similar vein, if the internal trainee's ability is a_{L2} his market wage is $f(n_{L2}^*)\gamma a_{L2} - wn_{L2}^*$, where we use $n_{L2}^* = n^*(a_{L2})$ to simplify notation, and the firm is indifferent between promoting this trainee and hiring from the outside (which yields zero profit). This determines a_{L2} through

$$f(n)a_{L2} - wn = f(n_{L2}^*)\gamma a_{L2} - wn_{L2}^*. \tag{7}$$

Finally, a_H is determined in a similar way as a_{L2}, through

$$f(n)a_H - wn = f(n_H^*)\gamma a_H - wn_H^*, \tag{8}$$

where $n_H^* = n^*(a_H)$. Again, it should be clear that a_{L2} and a_H are independent of ρ.

Given the optimal rule for internal promotions, we can now formally describe the equilibrium job assignments of old workers.

Lemma 1. *A worker j with managerial ability a_j will become a CEO if and only if either (i) $a_j \geq \bar{a}$ or (ii) he was placed in the trainee position in the first period and $a_j \geq a_{L1}(n)$.*

In words, the group of all CEOs includes all those workers whose ability turned out to be sufficiently high (higher than $\bar{a}$), plus all the trainees whose managerial skills are between $a_{L1}(n)$ and $\bar{a}$, where n is the size of their first-period employer. The group of the CEOs promoted from the inside consists of all the trainees whose managerial skills are between $a_L(n)$ and $a_H(n)$.

MARKET CLEARING. In equilibrium, the workers whose market wage is w must be indifferent between working in the corporate sector and working in the self-employment sector, that is, it must be that

$$w = \varphi(m/\kappa).$$

This implicitly defines the number of workers, m, working in the self-employment sector as a function of the wage w:

$$m(w,\kappa) = \varphi^{-1}(w)\kappa.$$

Because $\varphi(.)$ *is* a decreasing function, $m(w,\kappa)$ decreases in w. Note that since the total measure of workers is 1, the supply of workers in the corporate sector is given by $1 - m(w,\kappa)$, and the larger is κ, the higher is the elasticity of labor supply in this sector.

Finally, in equilibrium the measures of workers working in the two sectors must sum up to one:

$$\int_S n \int_{\bar{a}}^{\infty} [n^*(a)+1]\, dG(a)\, dH(n) + \int_{S_1} \left[\int_{\bar{a}}^{a_H(n)} (n - n^*(a)) dG(a) + \int_{a_{L1}(n)}^{\bar{a}} (n+1) dG(a) \right] dH(n)$$
$$+ \int_{S_2} \int_{a_{L2}(n)}^{a_H(n)} (n - n^*(a)) dG(a)\, dH(n) + m(w,\kappa) = 1 \qquad (9)$$

The first term in (9) is the measure of agents employed in newly established firms—those started by workers who worked in the industry when young and whose ability is at least $\bar{a}$. The remaining three integrals correct the first integral. The first term in the square brackets says that, in existing firms of size n such that $a_L < \bar{a}$, the trainees whose ability turned out to be between $\bar{a}$ and a_H were promoted to head their old firms and thus employ n rather than $n^*(a)$ non-managerial workers. The last term in the first line adds the workers who are employed by existing firms whose internal candidates turned out to be of lower ability than $\bar{a}$, but were promoted nevertheless, because their ability was higher than a_{L1}. The integral in the second line represents a correction for those established firms for which $a_L > \bar{a}$; it again says that all the trainees who were promoted to head their old firms employ n, rather than $n^*(a)$, non-managerial workers. Finally, $m(w,\kappa)$ is the measure of workers that chose to work in the self-employment sector.

Equations (2), (4), and (6) – (9) jointly determine the second-period market equilibrium in this economy, which will be denoted as (w^*, $\bar{a}^*$, $a_{L1}^*(n)$, $a_{L2}^*(n)$, $a_H^*(n)$, $n^*(a)$).

3.2 The Effects of an Increase in the Importance of the General Managerial Skill

As anticipated in the previous section, the ultimate goal of our analysis is to examine the effects on wages and CEO turnover of an increase in the relative importance of the general managerial skill. In other words, we are interested in what happens to the average

CEO wages, the average worker wages, the ratio of the average CEO wage to the average worker wage, and the probability that a firm's CEO will be hired from the outside, when the parameter γ increases. We start by examining the effects of an increase in γ on the equilibrium variables w^*, $\bar{a}^*$, $a_{L1}^*(n)$, $a_{L2}^*(n)$, $a_H^*(n)$, $n^*(a)$, and $w^{M*}(a)$.

Lemma 2. *For any γ and ρ from (0,1), any production functions f(n) and $\varphi(m)$, and any distribution functions H(n) and G(a), the effects of an increase in γ are characterized as follows:*

(a) $\frac{\partial w^*}{\partial \gamma} > 0$, $\frac{\partial a_{L1}^*(n)}{\partial \gamma} > 0$, $\frac{\partial a_{L2}^*(n)}{\partial \gamma} > 0$ *and* $\frac{\partial a_H^*(n)}{\partial \gamma} < 0$ *for all κ and n.*

(b) There exists a $\kappa^* < \infty$ such that if $\kappa > \kappa^*$, then $\frac{\partial \bar{a}^*}{\partial \gamma} < 0$, $\frac{\partial n^*(a)}{\partial \gamma} > 0$ *and* $\frac{\partial w^{M*}(a)}{\partial \gamma} > 0$ *for all a.*

(c) There exists an $a^+ < \infty$ such that $\frac{\partial w^{M*}(a)}{\partial \gamma} > 0$ *for all κ and all $a \geq a^+$.*

When the managerial skills become more general, each agent becomes more productive as a CEO in the outside market. If the wages of workers do not change, this higher productivity tends to increase the optimal size ($n^*(a)$) of the firm he should manage. Moreover, with w^* constant, higher market productivity also means higher market wages for CEOs ($w^{M*}(a)$), which increases the supply of potential CEOs and hence also the number of newly established firms. Consequently, demand for workers increases, which drives their equilibrium wage (w^*) up. Because the productivity of a CEO promoted internally does not depend upon the fraction of his skills that is transferable to other firms, an increase in γ, followed by the resulting increase in the wages of old non-managerial workers, make it less profitable to promote internal trainees, which is reflected in an increase in each firm's cutoff ability level a_L and a decrease in the cutoff level a_H.

The effect of an increase in γ on the equilibrium market wages of CEOs is somewhat more complicated. The direct effect is as described above, i.e., the CEO market wages tend to increase due to the CEOs' higher outside productivity. However, there is also an indirect effect, through an increase in worker wage w^*, which works in the opposite direction, decreasing the CEOs' outside productivity, and hence their market wages. The direct effect prevails, and the CEO market wages increase, if the worker wage does not increase too much, which holds if the elasticity of labor supply (captured by κ) is sufficiently large. These effects lead to our main results regarding the frequency of internal promotions, as well as the CEOs' absolute and relative total compensation, as described below.

THE EFFECTS OF AN INCREASE IN γ ON AVERAGE AND RELATIVE WAGES. Lemma 2 showed that if the supply of workers in the corporate sector is sufficiently elastic, an increase in γ causes a rise in the market wage of a CEO of any given ability a, as well as in the wage of non-managerial workers. This implies the following result.

Proposition 1. *As managerial skills become more general (γ increases), (i) the average worker wage always increases, and (ii) both the average market wage and average total pay of a CEO increase if the supply of workers in the corporate sector is sufficiently elastic (i.e., if κ is relatively large).*

Since for sufficiently elastic labor supply the average wages increase for both the managerial and non-managerial workers, the effect of an increase in γ on the *ratio* of the average CEO to the average non-managerial wages is less straightforward. However, as the following proposition shows, a sufficient condition for this ratio to be increasing in γ is again that labor supply in the corporate sector is sufficiently elastic.

Proposition 2. *Suppose that the supply of workers in the corporate sector is sufficiently elastic (i.e., κ is relatively large). Then as managerial skills become more general, both the average CEO market wage and the average total CEO pay increase relative to the average*

worker wage ($\frac{\partial(w^{M*}/w^*)}{\partial\gamma} > 0$ *and* $\frac{\partial(P^*/w^*)}{\partial\gamma} > 0$). *Moreover, the relative increase in both the CEO market wage and total pay is larger for higher ability CEOs* ($\frac{\partial^2(w^{M*}/w^*)}{\partial\gamma\partial a} > 0$ *and* $\frac{\partial(P^*/w^*)}{\partial a\partial\gamma} > 0$).

THE EFFECTS OF AN INCREASE IN γ ON THE PROBABILITY OF INTERNAL PROMOTION. As shown earlier, a given firm of size n promotes its first period trainee if and only if his managerial ability, $\hat{a}$, is from the interval $[a_L(n),a_H(n)]$. The comparative statics results in Lemma 2, according to which $a_L^*(n)$ increases and $a_H^*(n)$ decreases in γ, have the following immediate implication.

Proposition 3. *As managerial skills become more general (γ increases), the probability that any given firm fills its CEO position with an internal rather than an outside candidate decreases.*

As mentioned earlier, the productivity of a CEO promoted internally does not depend upon the fraction of his skills that is firm specific. Therefore, if there is an increase in the importance of the general managerial skill, the subsequent rise in the wages of old non-managerial workers makes internal promotions relatively less profitable. This induces the firms to decrease the set of ability realizations for which they are willing to promote the internal trainee.

A related implication of our model is that small firms (those with $n < \bar{n}$) become more likely to go out of business as γ increases, which follows directly from the fact that $a_{L1}(n)$ increases. The intuition is that an increase in the wage w that a firm with an internal candidate of low ability would have to pay its CEO makes it less likely that the firm would be able to break even.

4. Extensions

4.1 Endogenous skill choice

So far, we have treated the composition of an individual's managerial skills, captured by the parameter γ, as exogenous. However, since most of the predictions that we derive from our model are driven by a change in this parameter, ideally we would like to know what triggers this change and what determines γ in the first place. While we do not have a complete answer to these questions, in this subsection we make a step towards endogenizing γ, by letting workers choose their skill composition in the first period of their employment. Specifically, suppose that each worker employed in the corporate sector when young can choose how much effort, time, and other resources to invest into making his human capital more transferable across companies. To formalize this, assume that an old worker i's level of general skills, γ_i, is given by

$$\gamma_i = \gamma(e_i, \phi),$$

where e_i is the worker's first period investment. The fact that more investment makes the worker's skills more marketable is represented by the assumption that $\gamma_e(e_i, \phi) > 0$. Parameter ϕ measures how productive is a given level of investment. For example, ϕ could depend upon the level of general knowledge the society has accumulated about managing firms. The considerable progress that we have witnessed over the past decades in economics, finance, management, marketing, accounting, and other fields that enhance one's general ability to manage a modern company effectively would be captured by an increase in ϕ in our model. Arguably, due to this progress, any given amount of time and effort a worker spends mastering these fields enhances his general managerial skills more today than it would, say, thirty years ago. To capture this effect, we assume that $\gamma_\phi(e_i, \phi) > 0$ and $\gamma_{\phi e}(e_i, \phi) > 0$.

Investment in transferable human capital is costly – if a worker i invests an amount e, he has to bear a personal cost $c(e)$, where $c(.)$ is an increasing function. Finally, to keep the

analysis simple the and save on space, we will assume here that CEOs extract no rents, i.e., $\rho = 0$. Then, using the observation that, analogous to (3), the equilibrium wage of a worker of ability a_i is $w(a_i,\gamma) = \max\{w, \psi(a_i)\}$, worker i's optimal level of investment, e_i*, maximizes his expected utility,

$$E_a(U(e_i,\phi)) \equiv E_a(w(a,\gamma_i(e,\phi))) - c(e_i),$$

where $E_a(w(a,\gamma_i))$ is a young worker's expectation of his wage when old, conditional on the amount of his investment in general skills, e_i. We will assume that for any ϕ, the worker's optimization problem has an interior solution, $e_i^*(\phi)$, which is unique (a sufficient, but not necessary, condition for this is that $c(.)$ is convex and satisfies the usual conditions $c(0) = c'(0) = 0$ and $\lim_{e\to\infty} c(e) = \infty$). Worker i's investment problem can then be written as

$$\max_{e_i}\{w * G(\bar{a}) + \int_{\bar{a}}^{\infty}[f(n^*(a))a\gamma(e_i,\phi) - w * n^*(a)]dG(a) - c(e_i)\}.$$

This allows us to derive the following result.

Proposition 4. *As investment in general managerial skills becomes more productive, each worker optimally increases his investment in general skills, and this increases the proportion of his skills that is transferable across firms* ($\frac{\partial e_i^*}{\partial \phi} > 0$ *and* $\frac{\partial \gamma_i^*}{\partial \phi} > 0$).

To the extent that MBA education makes one's managerial skills more general, Proposition 4 implies that as MBA education becomes more efficient (either due to an advancement in economics, finance and other related fields, or due to some other change in the productivity of general skills), relatively more people acquire an MBA degree. Moreover, although our model does not speak to this directly, we would expect a relatively higher increase in the share of MBA educated CEOs among the CEOs hired from the outside than among those hired from the inside.

4.2 Specificity of managerial skills and the composition of the board of directors

Recent years have brought not only a pronounced increase in the absolute and relative pay received by the CEOs of the largest corporations, but also a gradual change in the composition of boards of directors, which are becoming increasingly independent (Holmstrom and Kaplan, 2003). The theory we are proposing here can also be applied to explain the latter trend. To see this, suppose that there are two types of directors: independent directors, recruited from outsiders not affiliated with the company, and inside directors, who serve — or served in the past — as the company's executives. The comparative advantage of inside directors is that they have firm-specific knowledge, which makes their services more valuable. On the other hand, just like with the CEOs, outside directors may have greater general ability and expertise, or represent a better match for the company, than the insiders, but they lack the firm-specific knowledge.

Formally, let $V(d_I,d_O,\gamma)$ be the net value to the firm created by a board of directors that consists of d_I insiders and d_O outsiders, conditional on the specificity of managerial ability being γ (where we again treat γ as exogenous). To some extent, the two types of directors are substitutes for each other; we will therefore assume that $V_{IO} < 0$, where V_x denotes the derivative of V with respect to d_x, $x = I,O$. To capture the idea that as the firm-specific skills become less important for running a company the outside directors' marginal productivity increases, we will assume that $V_{O\gamma} > 0$. On the other hand, the inside directors' productivity is unaffected by γ, so that $V_{I\gamma} = 0$. Finally, let $(d_I^*(\gamma),d_O^*(\gamma))$ be the unique board composition that maximizes $V(d_I,d_O,\gamma)$, and assume that $d_I^*,d_O^* \in (0,\infty)$. In this setting, the change in the optimal composition of a firm's board of directors in response to a change in the composition of managerial skills is characterized by the following proposition.

Proposition 5. *As managerial skills become more general, each firm optimally increases the number of outside directors* ($\frac{\partial d_O^*(\gamma)}{\partial \gamma} > 0$), *and decreases the number of inside directors* ($\frac{\partial d_I^*(\gamma)}{\partial \gamma} < 0$).

As the skills needed to manage a public corporation become more general, outside directors become relatively more efficient in monitoring a firm's management and this reflects in an increase in the optimal number of outside directors on the company's board. Moreover, because the outside and inside directors are partial substitutes in their monitoring and advisory functions, the number of inside directors optimally decreases.

5. Empirical Evidence and Alternative Explanations

The primary empirical implications of our model relate to the effect of increases in γ (the relative importance of general managerial capital) on CEO wages and the internal-vs.-external appointment decision. In particular, and assuming a sufficiently elastic supply for production workers, as managerial skills become more general (γ increases) we predict increases in CEO wages (in both absolute terms and relative to wages for production workers), in external hiring (relative to internal promotions), in investments in general skills, and in the proportion of outsiders on corporate boards of directors.

In this section, we offer indirect tests of our model. Testing our propositions directly requires a proxy for the relative importance of general managerial skills. While we cannot currently construct such a proxy, we document below both a decline in own-firm experience (a typical proxy for the level of firm-specific capital) and an increase in MBA education (a potential proxy for general managerial ability). In addition, we test our propositions indirectly by examining the correlation between outside hiring and CEO pay. Finally, we

consider alternative explanations for both the increase in pay levels and the shift towards external hires documented in Figures 1 and 2.

5.1 Indirect Evidence

Table 1 reports summary statistics for 2,783 CEOs appointed in 1,323 companies from 1970 through 2000. The full sample is based on 4,633 executives and 2,144 companies appearing in *Forbes* annual surveys between 1970 and 2000. As shown in Panel A, new appointments account for about 10% of the *Forbes CEOs* from 1970 to 1989; CEO turnover increased modestly to 11.3% in the 1990s. Although most newly appointed CEOs are promoted internally, the prevalence of external hires has increased dramatically, from 14.9% in the 1970s to 17.2% in the 1980s to 26.5% from 1990-2000. Panel B shows that the average age of newly appointed CEOs has increased slightly over the past three decades. Executives promoted internally tend to be older than those hired from the outside, but only the difference in the 1970s is statistically significant.

Our model predicts that if general managerial skills become more important, managers will spend more resources in acquiring this skill, at the expense of the firm-specific human capital. Panel C of Table 1 shows that the average job tenure (prior to CEO appointment) has declined substantially over the last thirty years, driven in a large part by the increased prevalence of outside hires (who, by construction, have a year or less of tenure upon appointment) and to a smaller degree by a decline in the average tenure for inside appointments. Panel D shows that newly appointed CEOs with MBA degrees have doubled from only 13.8% in the 1970s to 28.7% in the 1990s. CEOs hired from the outside in the 1970s were significantly more likely to have MBA degrees than those hired from the inside; this difference diminished in the 1980s and reversed in the 1990s. Overall, we view the decline in own-firm experience (the proxy for the level of firm-specific capital) and the increase in MBA education (the proxy for general managerial ability) as being consistent with our model.

We indirectly test our model by examining whether industry wage differences are explained, in part, by the prevalence of outside hiring within the industry. Implicitly, we allow for managerial capital that is industry specific but general within the industry. Given this assumption, a straightforward extension of our model suggests that industries with higher industry-specific γ's will have higher CEO pay and more outside hiring. We test this hypothesis using a two-step process. First, we estimate annual industry wage premiums by estimating the following regression:

$$ln(CEO\ Pay_{it}) = \alpha_t + \beta_t ln(Sales_{it}) + \mathbf{D}_{jt}, \tag{10}$$

where ln(CEO Pay_{it}) is the natural logarithm of the salary and bonus for a CEO in firm i in year t, and $\mathbf{D}_{jt}$ is a vector of year and industry-specific dummy variables based on one-digit primary SIC codes. The compensation data required to estimate (10), in thousands of 2002-constant dollars, are extracted from annual *Forbes* surveys, supplemented with data from Compustat's ExecuComp database. CEOs in their first partial year are excluded from this analysis.

In the second step, the estimated industry wage premiums, $\hat{\mathbf{D}}_{jt}$, are regressed on the prevalence of outside hires in the industry over years t-5 to t-1,

$$\hat{\mathbf{D}}_{jt} = \mu + \delta\left(\frac{External\ Hires\ in\ Industry\ j_{t\text{-}5\ to\ t\text{-}1}}{All\ CEO\ Hires\ in\ Industry\ j_{t\text{-}5\ to\ t\text{-}1}}\right). \tag{11}$$

Table 2 reports the coefficients from estimating (11). The coefficient on outside hiring of 1.196 is positive and statistically significant, indicating that industry wage premiums are, indeed, correlated with the prevalence of external CEO appointments in the industry. In particular, a ten-point increase in outside hiring (from, say 15 percent to 25 percent) results in additional industry wage premium of almost 13 percent.[12] We interpret this result as strong

[12] Calculated as $e^{1.196\times.10}-1\approx 0.127$.

evidence of an underlying connection between the trends in CEO pay and external appointments, which in turn provides circumstantial evidence consistent with our model.

5.2 Alternative Explanations

Bebchuk, Fried, and Walker (2002) and Bebchuk and Fried (2003) have argued that the escalation in CEO pay reflects that pay levels are determined not by competitive market forces but rather by captive board members catering to rent-seeking entrenched managers. Their rent-extraction view focuses on incumbent executives exercising power and influence over outside directors who are "connected to the executives by bonds of interest, collegiality, or affinity." A natural way to contrast their rent-extraction hypothesis with our model is to compare the compensation of CEOs hired from the outside (without established connections to the board) to CEOs hired from the inside (who presumably have such connections). In the Bebchuk-Fried-Walker model, CEOs promoted internally should earn more than CEOs hired from the outside. In our model (and as suggested by the results in Table 2), the increase in CEO pay is related to the increase in external hiring, not an increase in managerial entrenchment.

Table 3 reports coefficients from regressions explaining cross-sectional differences in CEO salaries and bonuses. The dependent variable for all regressions is the logarithm of cash compensation, and independent variables include the logarithm of company revenues (as a control for company size) and four zero-one dummy variables, including dummies for CEOs serving in their first year, CEOs originally hired externally, and the "External" dummy interacted with the new CEO dummies. The regressions also include 310 "industry-year" fixed effects (separate dummy variables for each year for each industry, based on one-digit primary SIC codes).

For our purposes, the most interesting coefficients in Table 3 are the coefficients on External Hire, which reflect wage premiums paid to CEOs hired from outside after their first

partial year in office. The coefficient in column (1) of Table 3 of .1421 is positive and significant, and indicates that CEOs hired from the outside earn approximately 15.3 percent more than CEOs who were promoted internally. The coefficients in columns (2), (3), and (4) indicate that the premium for external hires has increased over time, from 6.5 percent in the 1970s to 17.2 percent in the 1980s and 21.6 percent in the 1990s. These results suggest that the increase in CEO pay from 1970 to 2000 has been driven, at least, in part, by the increase in external hiring. We interpret these findings as being generally consistent with our model, but inconsistent with the Bebchuk-Fried-Walker hypothesis.[13] Indeed, under our approach, the increase in pay (coupled with the trend in external hires) is not only consistent with competition, but is evidence that the market for CEOs is becoming more important in determining CEO pay levels.

Note that the regressions in Table 3 include data for CEOs promoted or hired during the fiscal year, and these CEOs will predictably receive lower salaries and bonuses than CEOs in office for the entire year. Thus, the coefficient on "First Year as CEO" is negative and significant in all regressions in Table 3, reflecting mid-year appointments for internally promoted CEOs spending part of the year at a lower position in the company. Similarly, the (External Hire) × (First Year) dummy is negative and significant (except for in the 1970s, when the coefficients are positive but insignificant), indicating that partial-year CEOs hired from outside earn even less in their first year than internal promotions (because, external hires naturally earn *no* compensation from the company prior to their appointment).

Huson, Parrino, and Starks (2001) and Hermalin (2003) have suggested that the trend in outside hiring reflects greater board diligence in monitoring the CEO. Underlying these propositions are three stylized facts regarding CEO turnover: (1) there is an inverse relation

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[13] While in our model the average wage of the CEOs hired from the outside is not unambiguously higher than the average wage of the CEOs promoted internally, the model predicts a wage premium for external CEOs as long as the probability that a firm's inside candidate is 'too good' for the firm is sufficiently small (formally, $\int_{\underline{a}}^{a_H(n)} dG(a)$ is small). We believe that this is a reasonable assumption with respect to the companies in our sample, given that these companies represent the biggest firms in the economy.

between net-of-industry performance and the probability of management turnover (Coughlan and Schmidt, 1985, and Warner, Watts, and Wruck, 1988); the magnitude of the turnover-performance relation is strongest in companies dominated by independent outside directors (Weisbach, 1988); and (3) companies performing poorly relative to their industry are most likely to hire a replacement CEO from outside the firm (Parrino, 1997). Hermalin extends this argument to provide an explanation for the upward trend in compensation: CEO pay increases because more monitoring by the boards forces CEOs to exert more effort and consume fewer perquisites, for which they have to be compensated.

In our model, the increase in external hiring is driven by an increase in the relative importance of general managerial skills, and not by an increase in performance-related terminations. Columns (1) to (3) of Table 4 reports coefficients from ordinary least-squares regressions predicting the annual probability of CEO turnover as a function of firm performance and a dummy variable for retirement-aged CEOs.[14] In order to test whether performance-related dismissals have increased in recent years, we estimate the following regression for the 1970s, 1980s, and for 1990-2000:

$$\text{Prob(Turnover)} = a + b\begin{pmatrix} Dummy = 1 \\ if\ age \geq 64 \end{pmatrix} + c\begin{pmatrix} 2\text{-}Year\ Net\text{-}of\text{-} \\ Industry\ Return \end{pmatrix} \qquad (12)$$

The dependent variable is equal to 1 if the CEO is serving in his last full fiscal year and 0 otherwise.

The regression intercepts in columns (1) through (3) of Table 4 imply that a young executive in an average-performing firm (*i.e.,* realizing zero net-of-industry returns) had a departure probability of about 7.8% in the 1970s, 11.5% in the 1980s, and 21.1% in the 1990s. The coefficients on the retirement-age dummies are positive and significant but declining over time, suggesting that age is becoming a less important factor in executive

[14] We also estimated turnover probabilities using logistic methodologies and obtained qualitatively identical results; we focus on the OLS results because of efficiencies in interpretation and exposition.

departures. The negative and significant coefficients on two-year net-of-industry returns implies that departure probabilities for CEOs realizing returns 30% below the industry average were increased by 0.4% in the 1970s, 0.7% in the 1980s, and 0.4% in the 1990s. These findings are consistent with those of Mikkelson and Partch (1997) and indicate that the turnover-performance relation (measured by the increased departure probability associated with poor performance) has fallen since the 1980s. Taken together, our results indicate a structural shift in CEO departures over the past thirty years, but there is no evidence that the shift reflects increased board vigilance in replacing poorly performing managers.

Columns (4) through (6) of Table 4 report estimates from regressions predicting the probability of filling a CEO vacancy from outside the firm, based on the sample of 2,104 CEO departures from 1970 to 2000. The dependent variable is equal to 1 if the new CEO is hired externally, and 0 if the new CEO is promoted from within. The dependent variables are the same as in columns (1) and (3) and reflect the age and performance of the departing CEO. The coefficient on the two-year net-of-industry variable in column (4) is negative and (marginally) significant, indicating that outside replacements were more likely following poor net-of-industry performance than after good performance. However, by the 1990s (column (6)) there is no relation between performance and the probability of an outside hire (conditional on replacing the incumbent CEO). These results are also inconsistent with the claim that increased external hiring reflects increases in board vigilance.

6. Conclusion

The level of executive compensation is a controversial topic that attracts attention of both academic researchers and popular press. Arguably, to a large extent this attraction can be attributed to the pronounced and continuing increase in both absolute and relative levels of pay received by top executives in large companies. Some observers believe that this trend is a manifestation of an increased power that the self-dealing CEOs wield over captive

boards. This increased power, the argument goes, allows the CEOs to extract more rents from their companies, at the expense of the companies' workers and shareholders.

We argue that this explanation is not entirely convincing. There appears to be no reason why boards should be more captive today than they were twenty years ago. If anything, the evidence suggests the opposite, as the boards have become more independent over time. Moreover, CEOs hired from the outside appear to earn a premium compared to those promoted internally, which is hard to reconcile with the rent-extraction hypothesis.

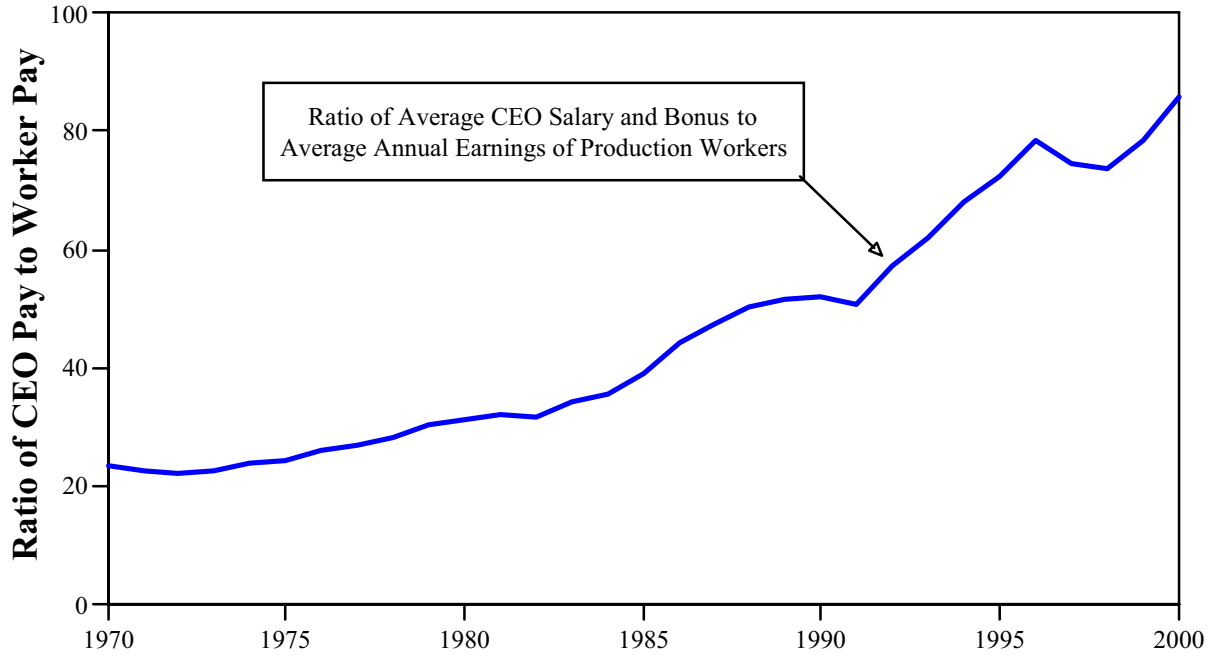
We offer an alternative view of what determines the level of CEO compensation and of the forces that lead to its absolute and relative increase. In our theory, the level of CEO pay is determined by competition among firms for top performing managers, and depends upon the portion of the CEOs' skills that is transferable across firms and industries. We suggest that the increase in executive compensation can be explained by an increase in the importance of general managerial skills, as opposed to firm-specific knowledge, in managing the modern corporation. As we show in the paper, this explanation is consistent not only with an increase in absolute and relative levels of CEO pay, but also with the observed increase in the share of CEO vacancies filled with external hires, with the increase in the share of external directors on corporate boards, with the increase in the share of CEOs with MBA degrees, and with the decline in the managers' average job tenure prior to being appointed CEO.

We offer several indirect tests of our model, including documenting that industry wage premiums are related to the prior prevalence of outside hiring within the industry. In addition, we present evidence counter to leading (but mutually inconsistent) alternative explanations for the increase in CEO pay (captive boards influenced by powerful incumbents) and external hires (increased board vigilance in replacing poorly performing managers). However, while we offer convincing circumstantial evidence consistent with a shift in the importance of managerial ability relative to firm-specific capital, we currently offer no direct evidence of why this shift has occurred. We have already suggested the

possibility that general managerial ability is becoming more productive due to the gradual accumulation of knowledge pertinent to the management of public corporations, including advances in accounting, economics, finance, marketing, and management science. In future research, we intend to identify these factors more precisely and to incorporate direct proxies for these changes into our empirical tests of the affect of managerial capital on the market for CEOs.

Figure 1

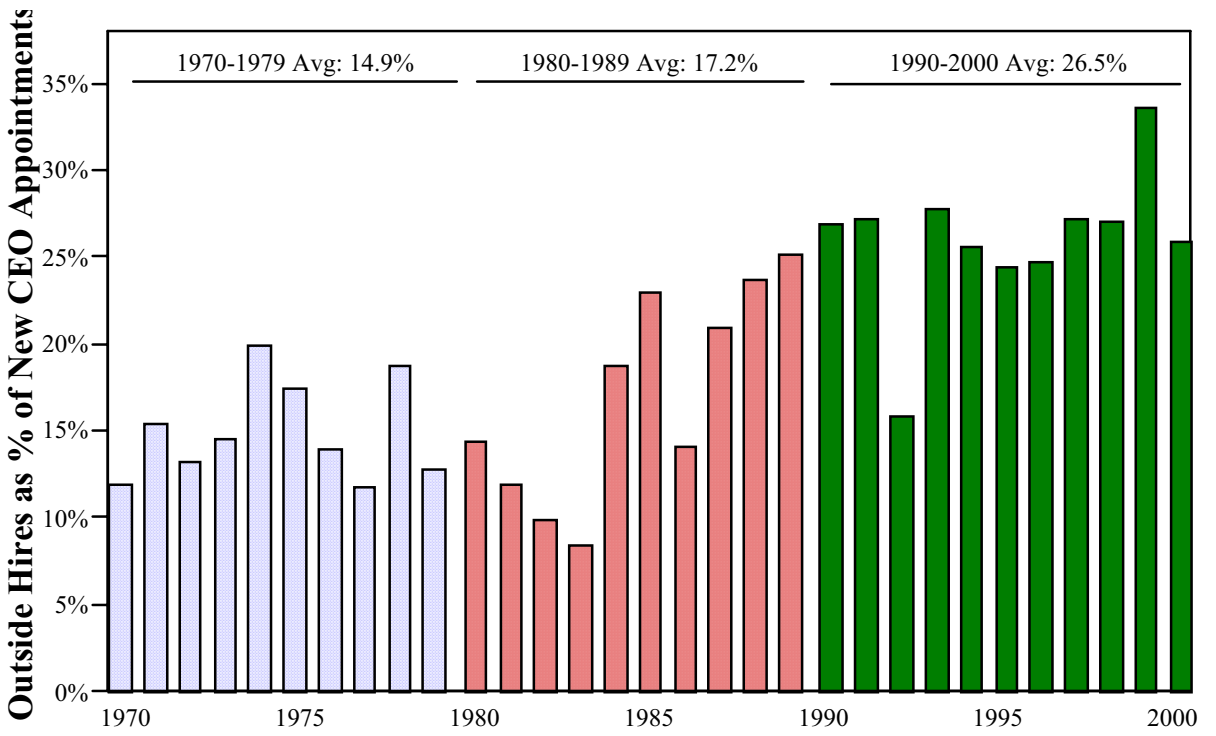
Ratio of Average CEO Pay to Average Pay for Production Workers, 1970-2000



Note: CEO sample is based on the *Forbes 800*, which includes all corporations ranked in the top 500 based on sales, assets, market capitalization, or income. The sample includes 4,597 executives from 2,144 firms from 1970 to 2000. Worker pay represents 52 times the average weekly hours of production workers multiplied by the average hourly earnings, based on data from the Current Employment Statistics, Bureau of Labor Statistics.

Figure 2

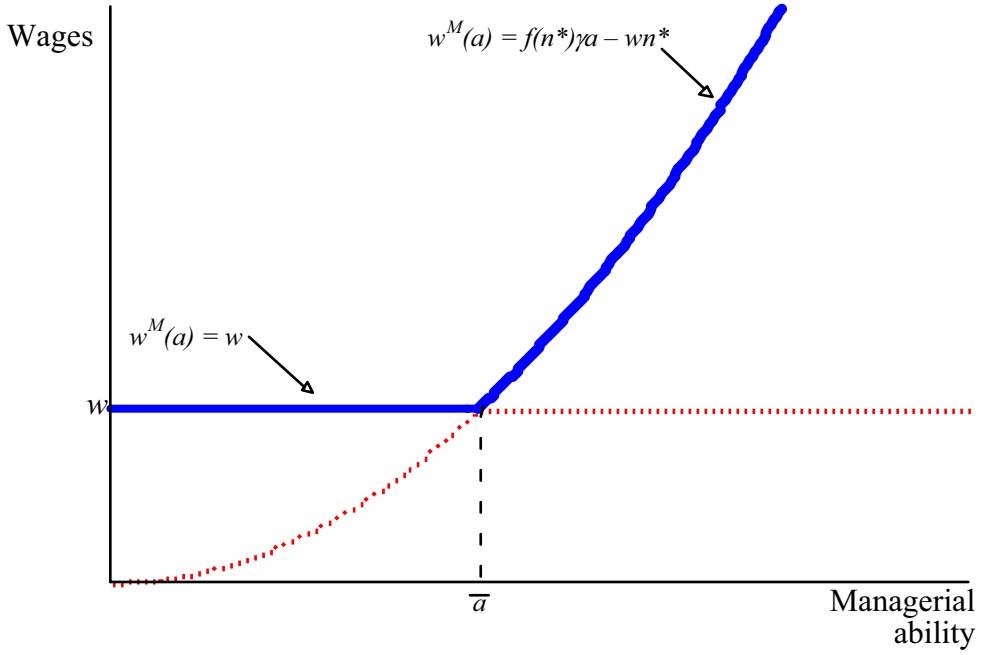
Outside Hires as Percentage of New CEO Appointments, 1970-2000



Note: Figure shows the fraction of newly appointed CEOs hired from the outside. Executives serving in their firm for less than a year before the CEO appointment are considered external hires, while those employed for more than a year are considered inside hires. Data include all companies appearing in *Forbes* annual surveys between 1970 and 2000, and include 2,783 newly appointed CEOs from 1,323 companies. (The full *Forbes* database includes 4,633 executives and 2,144 firms, but we exclude CEOs appointed prior to the first year the company is included in the *Forbes* surveys, and also exclude CEOs appointed after the last year the company is included in the *Forbes* surveys).

Figure 3

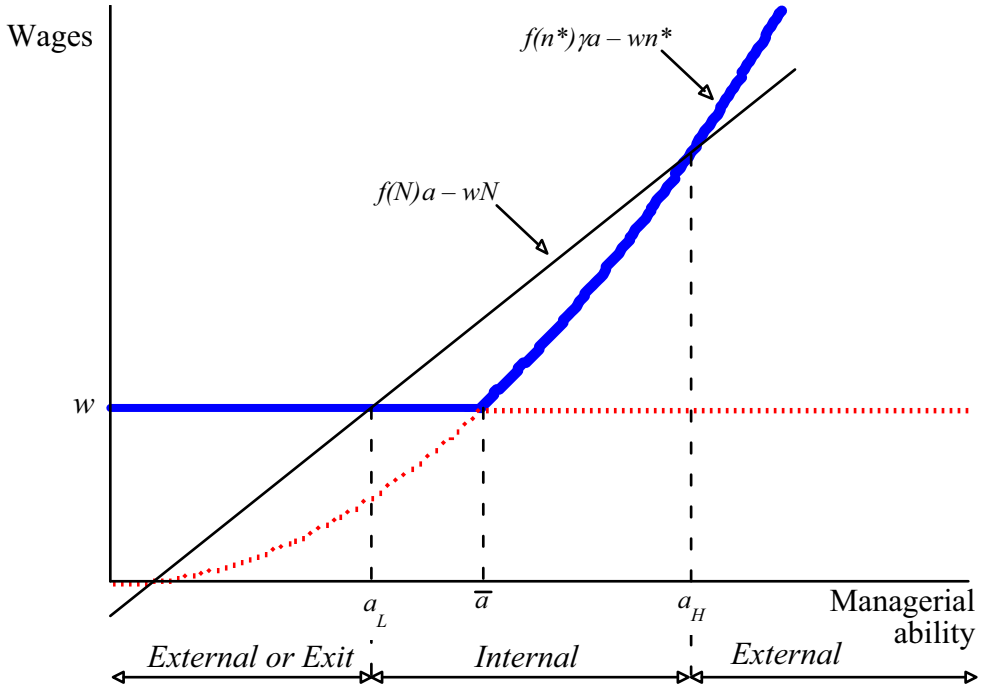
Market wages for managers and workers



Note: Figure illustrates how wages vary with managerial ability, a. Managers with $a < \bar{a}$ and all workers earn worker marginal productivity of w. Wages for managers with $a > \bar{a}$ are increasing and strictly convex in ability.

Figure 4

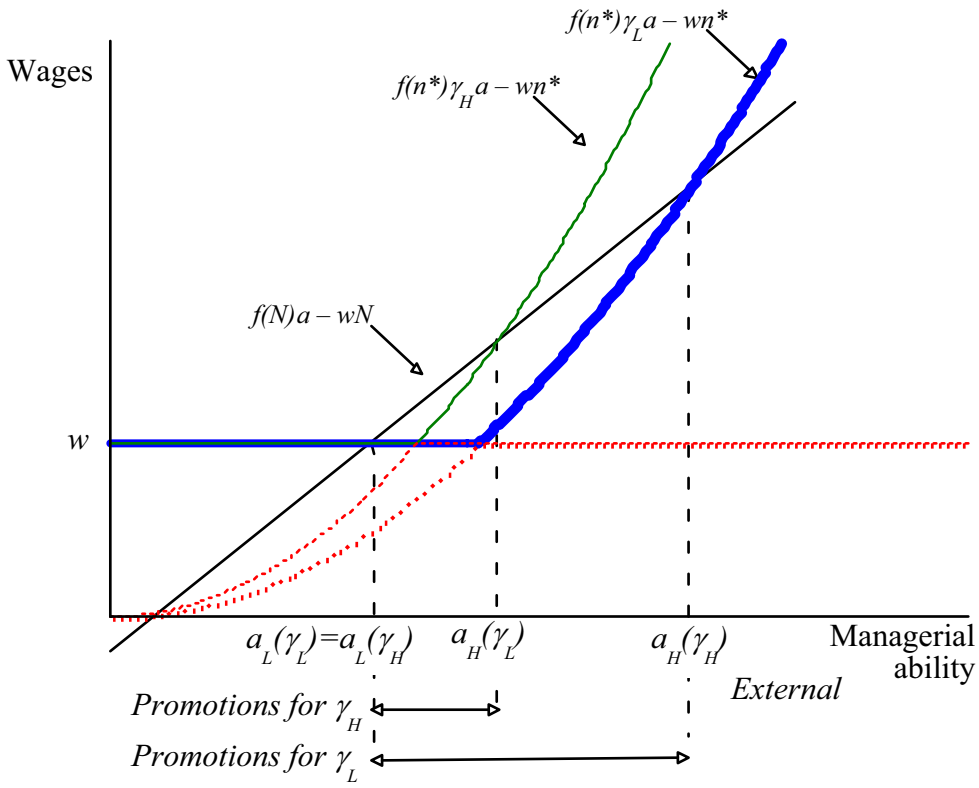
Firm choice between internal promotions and external hires



Note: Figure illustrates the internal vs. external hiring decisions for a firm with N workers. The firm will promote internally if its management trainee has ability within the "promotion range" of $a_L(N) \leq \hat{a} \leq a_H(N)$.

Figure 5

The effects of an increase in γ



Note: Figure 5 illustrates the effect of an increase in γ on managerial wages and on the promotion decision for a firm of size N. As γ increases from γ_L to γ_H, the wage function shifts upward from $w(a,\gamma_L)$ to $w(a,\gamma_H)$, while the "promotion range" (a_L,a_H) shrinks.

Table 1

Summary Statistics for Newly Appointed CEOs, 1970-2000

	1970-1979	1980-1989	1990-2000
Panel A			
Newly Appointed CEOs	903	888	992
As % of All CEOs	10.2%	10.0%	11.3%
Internal Promotions	85.1%	82.8%	73.5%
External Hires	14.9%	17.2%	26.5%
Panel B			
Age at CEO Appointment			
All New Appointments	53.3	53.3	53.9
Internal Promotions	53.2	53.5	53.5
External Hires	51.9	52.1	53.2
Panel C			
Tenure at CEO Appointment			
All New Appointments	18.2	17.2	14.1
Internal Promotions	21.3	20.7	19.2
External Hires	≤1.0	≤1.0	≤1.0
Panel D			
New CEOs with MBAs			
All New Appointments	13.8%	22.1%	28.7%
Internal Promotions	13.4%	21.1%	29.7%
External Hires	17.0%	28.3%	24.6%

Note: Executives serving in their firm for less than a year before the CEO appointment are considered external hires, while those employed for more than a year are considered inside hires. Data include all companies appearing in *Forbes* annual surveys between 1970 and 2000, and include 2,783 newly appointed CEOs from 1,323 companies.

Table 2

Coefficients from OLS regression of estimated annual industry wage premium on prevalence of outside hiring in the industry, 1970-2000

Independent Variable	*Dependent Variable:* Estimated Annual Industry Wage Premium
Intercept	.0828
Outside hires as % of CEO hires in the industry over prior five years	1.196 (4.5)
R^2	.102
Sample Size	182

Note: t-statistics in parentheses. The dependent variable is the estimated coefficient D_{jt} from annual regressions:

$$\ln(\text{CEO Pay})_{it} = \alpha_t + \beta_t \ln(\text{Sales})_{it} + \Sigma_{jt} D_{jt},$$

where $j \in \{1,7\}$ is the one-digit SIC industry (one-digit industries 8 and 9 and grouped with 7). The independent variable is the number of outside hires (relative to all CEO appointments) in industry j over the period t-5 to t-1.

Table 3

Coefficients of Fixed-Effects Regressions of Cash Compensation for CEOs Promoted Internally and Hired from Outside

Independent Variable	*Dependent Variable*: Ln(Salary + Bonus)			
	All Years	1970-1979	1980-1989	1990-2000
	(1)	(2)	(3)	(4)
Ln(Sales)	.2776 (81.0)	.2666 (70.0))	.2539 (54.2)	.3077 (39.1)
First Year as CEO	-.2098 (-15.9)	-.1886 (-13.8)	-.2184 (-12.2)	-.2229 (-6.9)
External Hire	.1421 (14.0)	.0633 (5.7)	.1591 (11.2)	.1956 (8.5)
(External Hire) × First Year as CEO	-.1341 (-4.3)	.0353 (1.0)	-.0911 (-1.9)	-.2541 (-3.8)
(Industry)×(Year) Fixed Effects	yes	yes	yes	yes
R^2	.424	.542	.441	.230
Sample Size	21,729	7,212	7,124	7,393

Note: t-statistics in parentheses. Executives serving in their firm for less than a year before the CEO appointment are considered external hires, while those employed for more than a year are considered inside hires. Data include 4,597 executives from 2,144 firms from 1970 to 2000. Industry-Year fixed effects based on one-digit primary SIC codes.

Table 4

Linear Probability Models Predicting CEO Departures Using CEO Age≥64, and Two-Year Net-of-Industry Returns

	Dependent Variable =1 if last year for CEO			Dependent Variable =1 if CEO is replaced from outside (Departing CEOs only)		
Independent Variable	1970-1979	1980-1989	1990-2000	1970-1979	1980-1989	1990-2000
	(1)	(2)	(3)	(4)	(5)	(6)
Intercept	.0781	.1154	.2108	.0130	.0195	.0450
(Dummy) Age ≥ 64	.2733 (25.5)	.2461 (21.9)	.1805 (13.0)	-.0041 (-0.5)	-.0123 (-1.4)	-.0296 (-2.0)
2-Year Net-of-Industry Return	-.0138 (-1.8)	-.0245 (-3.1)	-. 0137 (-4.9)	-.0190 (-1.7)	-.0186 (-1.6)	-.0019 (-0.5)
R^2	.084	.058	.024	.005	.006	.007
Sample Size	7,131	8,024	8,135	649	788	667

Note: t-statistics in parentheses. The dependent variable in columns (1) through (3) is equal to 1 if the CEO is serving in his last full fiscal year and 0 otherwise. The dependent variable in columns (4) through (6) is equal to 1 if the departing CEO is replaced by an external hire and 0 otherwise. Net-of-industry return equals the total shareholder return less the value-weighted return of all Compustat companies in the same two-digit SIC industry. Young CEOs are defined as CEOs younger than 64 as of the fiscal year-end. Qualitative results unchanged using logistic methodologies.

Appendix

Proof of Lemma 2: (a) The maximization problem (2) yields the following first order condition:

$$f'(n^*(a))\gamma a = w. \tag{13}$$

Let $\bar{n} = n^*(\bar{a})$. Conditions (13) and (4) imply that $f'(\bar{n})(\bar{n}+1) = f(\bar{n})$, which means that $\bar{n}$ is a constant. Next, note that the left hand side of (9), which represents demand for workers in the whole economy, decreases in w. Now assume for the moment that w does not change with γ. Then (13) immediately implies that $n^*(a)$ increases in γ, (4) implies that $\bar{a}^*$ decreases in γ, and (6) implies that $a_{L1}^*(n)$ is independent of γ. Differentiating (7) and (8) implicitly with respect to γ and using the Envelope Theorem, we get $\frac{\partial a_X^*(n)}{\partial \gamma} = \frac{a_X^* f(n_X)}{\gamma f(n_X) - f(n)}$, where $X = L,H$. Since $\gamma f(n_H) - f(n) > 0$, while $\gamma f(n_L) - f(n) < 0$, we get that if w does not change with γ, then $\frac{\partial a_H^*(n)}{\partial \gamma} < 0$ and $\frac{\partial a_{L2}^*(n)}{\partial \gamma} > 0$. Applying all these results to examine the effects of an increase in γ on the demand for workers, we find that the left hand side of (9) increases in γ, i.e., there is excess demand for workers if wage does not adjust. Because in equilibrium the labor markets must clear and because the demand for workers decreases in w, it follows that w^* must increase in γ, which proves $\frac{\partial w^*}{\partial \gamma} > 0$. Condition (6) then immediately yields $\frac{\partial a_{L1}^*(n)}{\partial \gamma} > 0$.

Next, the first order condition (13) must hold for all ability levels, which means that $f'(n_H^*)\gamma a_H^* = w^*$. Plugging this to (8), we have

$$\gamma f(n_H^*) - f(n) = f'(n_H^*)\gamma(n_H^* - n).$$

Implicit differentiation with respect to γ then yields

$$\frac{\partial n_H^*}{\partial \gamma}\gamma f''(n_H^*)(n_H^*-n) = f(n_H^*) - f'(n_H^*)(n_H^*-n) \ .$$

Using $n_H^* > n$ and strict concavity of *f(.)* we get $\frac{\partial n_H^*}{\partial \gamma} < 0$, because $f'(n_H^*) < \frac{f(n_H^*)}{n_H^*} < \frac{f(n_H^*)}{n_H^*-n}$. But from the first order condition (13), n_H^* monotonically increases in a_H^*, which means that it also must be that $\frac{\partial a_H^*}{\partial \gamma} < 0$.

The same arguments can be used to show that $\frac{\partial a_{L2}^*(n)}{\partial \gamma} > 0$. Combining (13) and (7) we obtain

$$\frac{\partial n_{L2}^*}{\partial \gamma}\gamma f''(n_{L2}^*)(n_{L2}^*-n) = f(n_{L2}^*) + f'(n_{L2}^*)(n-n_{L2}^*),$$

from which $\frac{\partial a_{L2}^*}{\partial \gamma} > 0$, because $n_{L2}^* < n, f' > 0, f'' < 0$, and $\frac{\partial n_{L2}^*}{\partial a_{L2}} > 0$.

(b) Assume for the moment that w^*/γ is independent of γ. Then (13) and (4) respectively imply that $n^*(a)$ and $\bar{a}^*$ are both independent of γ, while (6) means that $a_{L1}^*(n)$ increases in γ. Moreover, from part (a) we know that $a_{L2}^*(n)$ increases and $a_H^*(n)$ decreases in γ. Using these results, together with $m'(w) < 0$, to evaluate the effect of an increase in γ on demand for workers, we find that the left hand side of (9) decreases in γ if κ is sufficiently large. This means that the increase in w^* must be smaller than assumed if an equilibrium in the labor market is to be restored, that is, w^*/γ must decrease in γ if κ is sufficiently large. Conditions (13) and (4), together with $w^{M*} = f(n^*(a))\gamma a - w^*n^*(a)$ then deliver the inequalities in part (b) of the lemma in a straightforward way.

(c) We have $\frac{\partial w^{M*}(a)}{\partial \gamma} = f(n^*)a - \frac{\partial w^*}{\partial \gamma}n^* > 0$ if and only if $\frac{f(n^*)a}{n^*} > \frac{\partial w^*}{\partial \gamma}$. Now, using

$\lim_{a\to\infty}\frac{\partial n^*}{\partial a} = \lim_{a\to\infty}\frac{-f'(n^*)}{af''(n^*)} = 0$, $\lim_{a\to\infty} f'(n^*)a = \lim_{a\to\infty} w^*/\gamma = w^*/\gamma$, and $\lim_{a\to\infty} f(n^*) =$

∞, we get $\lim_{a\to\infty} \frac{f(n^*)a}{n^*} = \frac{\lim_{a\to\infty}[f(n^*) + af'(n^*)\partial n^*/\partial a]}{\lim_{a\to\infty} \partial n^*/\partial a} = \infty$. Hence, there exists an a^+ such that $\frac{f(n^*)a}{n^*} > \frac{\partial w^*}{\partial \gamma}$, and therefore $\frac{\partial w^M{}^*(a)}{\partial \gamma} > 0$, for all $a \geq a^+$.

Note that none of the arguments in this proof depend upon the value of the rent-extraction parameter ρ. Q.E.D.

Proof of Proposition 1: Claim (i) and the first part of claim (ii) follow immediately from Lemma 2. To see that the second part of claim (ii) holds, i.e., that the total compensation of an average CEO increases with γ, notice first that it is again immediate from Lemma 2 that the total pay of the CEOs who receive no rents increases with γ if κ is sufficiently large, because their total compensation is equal to their market wage, $w^{M^*}(a)$. For those CEOs who do receive rents it must be that *s = 1*, so that their total equilibrium pay can be written as

$$P(n,a,\gamma) = w^{M^*}(a) + \rho\pi(n,a,s) = (1-\rho)w^{M^*}(a) + \rho[f(n)a - w^*n].$$

This increases in γ if $(1-\rho)\frac{\partial w^{M^*}(a)}{\partial \gamma} - \rho n \frac{\partial w^*}{\partial \gamma} > 0$. Using $\frac{\partial w^{M^*}(a)}{\partial \gamma} = f(n^*)a - \frac{\partial w^*}{\partial \gamma} n^*$, the latter inequality becomes

$$(1-\rho) f(n^*)a > [(1-\rho)n^* + \rho n]\frac{\partial w^*}{\partial \gamma}. \qquad (14)$$

Now, differentiating the left hand side of (9) with respect to γ, and letting $\kappa \to \infty$, we see that the derivative approaches -∞ if $\frac{\partial w^*}{\partial \gamma} > 0$ and +∞ if $\frac{\partial w^*}{\partial \gamma} < 0$. Neither of these cases can be true in equilibrium, as (9) must hold for any given γ, i.e., the derivative of the left hand side of (9) must be zero. Therefore, it must be that $\frac{\partial w^*}{\partial \gamma} = 0$. By continuity in κ, this implies that (14) holds for κ sufficiently large. Q.E.D.

Proof of Proposition 2: For any given ability level, *a*, we have $\frac{\partial(w^{M*}/w*)}{\partial\gamma} > 0$ if and only if $\frac{\partial w^{M*}(a)}{\partial\gamma} w* - \frac{\partial w*}{\partial\gamma} w^{M*}(a) > 0$. Using $w^{M*}(a) = f(n*(a))\gamma a - w*n*(a)$ and $\frac{\partial w^{M*}(a)}{\partial\gamma} = f(n*)a - \frac{\partial w*}{\partial\gamma} n*$, the above inequality becomes $\frac{\partial w*}{\partial\gamma}\frac{\gamma}{w*} < 1$. Thus, the ratio of the CEO to worker wage has the same sign for any given ability level and depends only upon the elasticity, $e = \frac{\partial w*}{\partial\gamma}\frac{\gamma}{w*}$, of the equilibrium worker wage with respect to γ. But $e < 1$ if and only if $w*/\gamma$ decreases in γ. This holds if κ is sufficiently large, as shown in the proof of part (b) in Lemma 2.

Similarly, $\frac{\partial(P*(a)/w*)}{\partial\gamma} > 0$ if and only if $\frac{\partial P*(a)}{\partial\gamma} w* - \frac{\partial w*}{\partial\gamma} P*(a) > 0$. We have shown in the proof of Proposition 1 that $\frac{\partial P*(a)}{\partial\gamma} > 0$ and $\frac{\partial w*}{\partial\gamma} = 0$ as $\kappa \to \infty$. Therefore, by continuity in κ, the inequality must hold for κ sufficiently large.

To prove the second claim, note first that $\frac{\partial(w^{M*}/w*)}{\partial a} = \frac{f(n*(a))\gamma}{w*}$, so that $\frac{\partial^2(w^{M*}/w*)}{\partial\gamma\partial a} > 0$ if and only if $\frac{\partial n*(a)}{\partial\gamma} f'(n*(a))\gamma + f(n*(a)) > 0$, which holds if κ is sufficiently large, because then $\frac{\partial n*(a)}{\partial\gamma} > 0$ (by Lemma 2b). Similarly, using the expression for *P(a)* derived in the proof of Proposition 1, we have $\frac{\partial(P*/w*)}{\partial a} = (1-\rho)\frac{\partial(w^{M*}/w*)}{\partial a} + \rho f(n)$, so that $\frac{\partial(P*/w*)}{\partial a\partial\gamma} = (1-\rho)\frac{\partial(w^{M*}/w*)}{\partial a\partial\gamma}$, which is positive for large κ, as proved above. Q.E.D.

Proof of Proposition 3: Since the probability of internal promotion in a firm of size n is proportional to $\int_{a_L^*(n)}^{a_H^*(n)} dG(a)$, the claim follows immediately from part (a) in Lemma 2, according to which $a_{L1}^*(n)$ and $a_{L2}^*(n)$ increase and $a_H^*(n)$ decreases in γ. Moreover, the probability of external promotions is proportional to $\int_{a_H^*(n)}^{\infty} dG(a)$, which increases in γ, due to a decrease in $a_H^*(n)$. Q.E.D.

Proof of Proposition 4: Differentiating the worker's objective function with respect to ϕ and e_i yields $\frac{\partial^2 E_a(U(e_i,\phi))}{\partial\phi\partial e} = \int_{\bar{a}}^{A} f(n^*(a))a\gamma_{e\phi}(e_i,\phi)dG(a) > 0$. Hence, $E_a(U(e_i,\phi))$ exhibits increasing differences in e_i and ϕ, which means that e_i^* increases in ϕ (Milgrom and Roberts, 1990). Q.E.D.

Proof of Proposition 5: The assumptions on the second derivatives of V mean that $V(-d_I,d_O,\gamma)$ is supermodular, which immediately implies that d_O^* increases and d_I^* decreases in γ (Milgrom and Roberts, 1990). Q.E.D.

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