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External Recruitment versus Internal Promotion

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This article analyzes the choice between internal promotion and external recruitment within the framework of an economic contest. Opening up the competition for a position to external candidates reduces the chance of promotion for existing workers and therefore their incentive to work. Increasing the prize for winning can maintain incentives but is limited by moral hazard and potentially disruptive office politics. Alternatively, a competitive handicap can be awarded to existing workers to boost their chances. This strategy is consistent with the general observation that an external candidate is recruited only if she is significantly superior to the internal contestants.

I. Introduction

When it comes to personnel changes in corporations, it is usually the movements across firms that grab the headlines. Certainly, Lee Iacocca taking over at Chrysler or Louis Gerstner brought in for the top job at IBM caught the public's fancy and Wall Street analysts' attention more so than Alexander Trotman being elevated to CEO at Ford Motor. It may, therefore, come as a minor surprise that, in corporate America, for every single Iacocca or Gerstner, there are more than six Trotmans. A cursory check of the records reveals that among the 84 chief executives of the Fortune 100 firms who were promoted to the position since 1984,

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only 11 were recruited from outside the organization. In Japan and other Asian economies, the ratio is likely to be even lower. Such an observation at the top echelon of large corporations is only the most visible illustration of a widespread phenomenon—many business and nonprofit organizations tend to promote from among their own ranks rather than recruit externally in filling higher positions.

There are a number of reasons for this practice, of which perhaps the most often cited is specific human capital considerations. It is a well-known result in human capital theory that accumulation of firm-specific human capital usually involves joint investment by both the employer and the employee, so that both parties have the incentive to maintain a long-term relationship (see, e.g., Becker 1975). And the longer the tenure of the worker, the more specific human capital accumulated, and the more costly it would be for the firm to find an external candidate who could outperform an existing worker within the setting of the firm. Another possibility is that the abilities of existing employees can be observed with less noise than those of external applicants, so that risk-averse employers may prefer to go with a less uncertain prospect by promoting qualified candidates from within (Greenwald 1979). Yet, even in situations where specific human capital is relatively unimportant and reliable information about external candidates is available, the preference for internal promotion remains, particularly in large firms with bureaucratic structures and institutionalized career ladders. Recruitment and training costs aside, many firms or organizations are simply reluctant to recruit marginally better outsiders when adequate internal candidates are available. Only when an external candidate shows a significant margin of superiority will existing employees be passed over for promotion.

Much of this phenomenon, I believe, can be attributed to the use of promotion or other forms of pecuniary or nonpecuniary rewards as a carrot for inducing effort from workers, particularly when the cost of monitoring such effort is high. If competition within an organization for senior positions can be represented as a rank-order tournament with a relatively small number of players, then opening the competition to external candidates can be similarly analyzed, albeit now with a far larger number of contestants. Requiring a firm's employee to compete against not only her colleagues (whose strength she at least has some idea of) but also any number of external applicants drastically reduces the employee's chance of winning, and with it her incentive to exert and compete. To maintain the incentive to work, the firm must promise a larger prize for winning to make up for the smaller probability of winning. But a widening wage spread introduces problems of its own. In particular, the employer has the incentive to cheat an internal contestant of her victory so as to avoid paying her the prize, while competition among internal contestants may induce noncooperation and even sabotage among workers within the firm (Lazear 1989), both of which would render a "fair" contest with a large prize impracticable. With the winning spread likely to be constrained, another incentive device must be employed, and very often it is a handicap given to internal candidates. By rigging the game in their favor, the firm can circumvent the constraints on the wage structure and make the expected return large enough at the margin to induce efficient effort. As a result of such a scheme, we will, more often than not, observe internal promotion and that the quality of external recruits is usually significantly, rather than marginally, higher than internal candidates who lost in the contest.

The study of rank-order tournaments as efficient contracts is, of course, not new, as the seminal work of Lazear and Rosen (1981) has inspired a rather extensive literature that touches on many facets of the scheme, ranging from early studies on its comparative efficiency (Green and Stokey 1983; Nalebuff and Stiglitz 1983) to different variations on the setup of the game (Rosen 1986; Bhattacharya and Guasch 1988; Drago and Turnbull 1988; Glazer and Hassin 1988), to empirical and sometimes experimental study of its incentive effects (Bull, Schotter, and Weigelt 1987; Ehrenberg and Bognanno 1990; and, a number of articles in a special issue of *Industrial and Labor Relations Review* 1990). In particular, Nalebuff and Stiglitz (1983), O'Keeffe, Viscusi, and Zeckhauser (1984), and McLaughlin (1988) analyze contests with multiple players and the effect of the number of players on the optimal structure of the contest, arriving at the intuitive conclusion that the wage spread tends to increase as the field gets crowded. This proposition is supported by empirical results in Main, O'Reilly, and Wade (1993). Yet, in none of these works is there any distinction made between internal and external contestants. The difference is important because the current performance of a firm depends on the effort of the former but not that of the latter. The firm must therefore provide incentives for its own workers to exert (without encouraging excessively aggressive competitive behavior), while it need not do so for the external applicants, at least not until they join the firm in the future if they happen to win the contest in the current period.[1] The problem analyzed in this article is therefore different from one that does not recognize organizational boundaries. I believe it is a more realistic representation of the personnel decisions that firms have to make and offers insights into management practices that may otherwise seem inefficient.

[1] It is also optimal for the firm to bring in external competition as a means of discouraging collusion (Dye 1984) or sabotage (Lazear 1989) among existing workers. The implications of this function are, however, not formally explored in this model.

This article is organized as follows: the basic assumptions and setup of a conventional model of a contest with internal and external contestants, as well as the limitations of the solution, will be discussed in the next section. Section III explores an alternative contract with a competitive handicap for internal contestants when the spread between wages is constrained. It will be shown that such a contest induces efficient effort from existing workers but only at the cost of reduced mobility and lower average productivity. On a more positive note, the use of competitive handicap allows another degree of freedom in the design of incentive systems that may be invaluable when the wage structure is constrained and workers are risk averse. The article ends with a conclusion in Section IV.

II. Contest with Homogeneous Internal and Heterogeneous External Candidates

Consider a firm with a position to fill. For simplicity, suppose there are two existing employees at a lower position who are being considered. Given that the firm has had the opportunity to observe its workers and pick the two for consideration, they should be relatively homogeneous. For our analysis, we shall assume that they are ex ante identical, with known abilities ($\alpha_1 = \alpha_2$, where workers 1 and 2 are the internal contestants). External competition comes from outside applicants who may be workers terminated elsewhere under up-or-out contracts, new entrants into the market, or any worker seeking a change in career for reasons exogenous to this model. The number of applicants would perceivably depend on the market supply of the relevant type of workers, as well as the effort made by the firm in soliciting such competition (e.g., the size and duration of the "help wanted" advertisement), but both are taken as given here for simplicity. Specifically, it is assumed that there is an exogenously determined N external applicants for the position, the ability of each of which (α_x) is not known a priori, but the density of abilities from which they are drawn ($f(\alpha)$, assumed unimodal with range $[\alpha_a, \alpha_b]$) is common knowledge.

It is further assumed that the effort of either the internal or external candidates (μ_1, μ_2, and μ_x, respectively) cannot be directly observed, but their performance or outputs (q_1, q_2, and q_x) in their respective firms (e.g., sales figures or physical quantities of output produced) can be and will be used as the basis of determining the outcome of the contest. In the case of new labor market entrants, their market productivity will be imputed from their educational credentials. To simplify the analysis, output is assumed to depend additively on the effort of the worker and a mean zero error term, ε (i.e., $q = \mu + \varepsilon$), assumed independently and identically distributed across the contestants with unimodal, symmetric, and differentiable density $g(\varepsilon)$. The relationship between the effort (and, therefore, output) and ability of each worker depends on the incentive scheme in the firm for which she works. It is one of the results derived in this article that, in an optimal contest, the effort of the internal contestants is a positive function of their ability (as defined below). In an efficient labor market, we would expect that the same holds in other firms as well, even if the structures of the incentive schemes differ, so that the observed output of the external contestants can be considered to be a random variable induced by their unobserved abilities as well as the random error term (i.e., $q_x = \mu_x(\alpha_x) + \varepsilon_x$). In order to highlight the incentives and effects of competition in an internal labor market, it is assumed that the internal contestants do not consider external opportunities due, for example, to substantial investment in firm-specific human capital.[2] Physical capital is ignored without apology.

In this section, we shall start with a fair contest: the individual with the highest output in this period will be appointed to the position in the next period. If one of the existing workers turns out to be the winner, then she gets the higher wage (the base wage, W_0, plus a raise throughout her remaining tenure the discounted present value of which is equal to ΔW)[3] that goes with the position, with the loser getting W_0. If an external contestant wins, she will be given the position and a contract starting the following period, which is worth the expected value of her marginal product (she will be paid by her current employer this period), given competition in the external market while both internal contestants are paid W_0. We can treat this as a repeated game, with a finite expected tenure for the senior position, because of either possible retirement or promotion of the winner (by winning another contest) to a more senior level after a (certain) period, so that the incentive for the losing internal contestant(s) to strive for promotion remains. Finally, all agents are assumed to be risk-neutral inhabitants of a perfectly competitive world in which the product of their labor is sold at a fixed price, V.

Within this setting, the tournament we are analyzing is an incentive contract for the internal contestants only. It is their behavior in the face of potential external competition that the firm is interested in since current profit depends on their effort but not on that of the external applicants.

[2] The implicit asymmetry in mobility cost, zero for external workers moving in but infinite for internal workers moving out, means that the analysis is strictly partial equilibrium in nature and has nothing to say about mobility in a general equilibrium.

[3] The assumption that the prize for winning is amortized is made only to facilitate interpretation: promotion usually carries a permanent rather than a temporary raise. In fact, in this article promotion is used synonymously with an increase in wage and carries no implications on the role of the workers in production.

Because of random noise in the production of outputs, the contestants have only partial control of the outcome. Given a value of ε_i and her ability, α_i, internal contestant i's chance of beating her colleague is $G(\mu_i + \varepsilon_i - \mu_j)$, while that of winning against a randomly picked external challenger is

$$\int_{\alpha_a}^{\alpha_b} G[\mu_i + \varepsilon_i - \mu_x(\alpha_x)]dF(\alpha_x),$$

where F and G are the distribution functions of α_x and ε, respectively. Since the ε's are independent, the unconditional probability of i's winning the prize, ΔW, is

$$P_i = \int_{-\infty}^{\infty} G(\mu_i + \varepsilon_i - \mu_j)\left(\int_{\alpha_a}^{\alpha_b} G(\mu_i - \mu_x(\alpha_x) + \varepsilon_i)dF(\alpha_x)\right)^N dG(\varepsilon_i)$$

for $i = 1, 2$ and $j \neq i$. Worker i's objective is to maximize her net expected payoff (since risk neutrality is assumed) given this probability and the structure of the game, while the firm's objective, given perfect competition, is to design a contract $(W_0, \Delta W)$ that maximizes the expected utility of i and j, given a zero expected profit constraint and the workers' behavior. Formally, the firm's problem is as follows:

$$\begin{aligned}\max_{W_0,\Delta W} \int U_i dG(\varepsilon_i) &= (W_0 + \Delta W) \int G(\mu_i + \varepsilon_i - \mu_j) \\ &\quad \times \left\{\int G[\mu_i + \varepsilon_i - \mu_x(\alpha_x)]dF(\alpha_x)\right\}^N dG(\varepsilon_i) \\ &\quad + W_0\left[1 - \int G(\mu_i + \varepsilon_i - \mu_j)(E_\alpha G)^N dG(\varepsilon_i)\right] \\ &\quad - C(\mu_i, \alpha_i) \\ &= W_0 + P_i \Delta W - C(\mu_i, \alpha_i)\end{aligned}$$

subject to

$$W_0 + P_i \Delta W = E(Vq_i) = V\mu_i$$

and

$$\mu_i \in \operatorname{argmax}\left(\int U_i dG(\varepsilon_i) = W_0 + P_i \Delta W - C(\mu_i, \alpha_i)\right)$$

for $i = 1, 2$ and $j \neq i$, where $E_\alpha G = \int G[\mu_i + \varepsilon_i - \mu_x(\alpha_x)]dF(\alpha_x)$, the expected chance of success against an external candidate, and $C(\mu_i, \alpha_i)$ is the monetary value of the disutility of effort. It is assumed that $C_1 > 0$, $C_{11} > 0$, and $C_{12} < 0$, so that the marginal disutility of work is lower for higher ability workers at any given level of effort.

The second constraint, incentive compatibility, characterizes the utility-maximizing behavior of the internal contestants that the firm must take into account. It implies that

$$\begin{aligned}\Delta W(\partial P_i/\partial \mu_i) &= \Delta W \int [g(\mu_i + \varepsilon_i - \mu_j)(E_\alpha G)^N \\ &\quad + G(\mu_i + \varepsilon_i - \mu_j)N(E_\alpha G)^{N-1}E_\alpha g]dG(\varepsilon_i) \qquad (1)\\ &= C_1(\mu_i, \alpha_i),\end{aligned}$$

which equates the expected marginal benefits to the worker of increasing effort to its marginal disutility.[4] The former arises from a higher probability of winning against the other internal contestant, captured by the first term in the integral, as well as against the external candidates, captured by the second term. Rearranging gives the wage spread as

$$\Delta W = \frac{C_1(\mu_i, \alpha_i)}{\int_{-\infty}^{\infty} [g(\mu_i + \varepsilon_i - \mu_j)E_\alpha G + NG(\mu_i + \varepsilon_i - \mu_j)E_\alpha g](E_\alpha G)^{N-1}\, dG(\varepsilon_i)}.$$

In equilibrium, symmetry dictates that $\mu_i = \mu_j$. If all contestants, internal and external, are homogeneous and all firms are equally efficient in inducing effort, then $E_\alpha G = G(\varepsilon)$ and ΔW simplifies to $C_1/((N + 1) \times \int\{g(\varepsilon)[G(\varepsilon)]^N\}dG(\varepsilon))$.[5]

[4] There are two potential problems with this "first-order approach." The second-order condition for the maximizing problem depends on the distributions of the random variables, and no Nash equilibrium exists if the condition is violated. However, as shown in McLaughlin (1988), a unique Nash equilibrium is guaranteed in our case by our assumptions about $g(\varepsilon)$. The second concerns the global incentives condition discussed in O'Keeffe, Viscusi, and Zeckhauser (1984). Briefly, a local interior solution may be dominated by a corner solution in which the agent simply gives up and settles for the losing prize if the level of effort in the interior solution is too high. In what follows, it is assumed that the conditions for a global maximizing interior solution, discussed in McLaughlin (1988), are satisfied.

[5] In the absence of external competition, it further reduces to $\Delta W = C_1/\int g(\varepsilon)dG(\varepsilon)$, which is equivalent to eq. (6) in Lazear and Rosen (1981).

Substituting the zero expected profit constraint into the expected utility of worker i, the firm's problem can be rewritten as

$$\max_{W_0, \Delta W} EU_i = V\mu_i - C(\mu_i, \alpha_i),$$

subject to equation (1), with μ_i being an implicit function of W_0 and ΔW. The first-order conditions are

$$(V - C_1)\partial\mu_i/\partial x = 0$$

for $x = W_0, \Delta W$. Since $\partial\mu_i/\partial x$ is in general nonzero, the conditions reduce to $V = C_1$. Thus, the contract that arises as the solution to the firm's problem is efficient in the sense that it induces the socially optimum effort from the worker. Replacing C_1 with V in (1) and using the zero expected profit constraint gives the terms of the optimum contract as

$$\Delta W = \frac{V}{\int_{-\infty}^{\infty} [g(\varepsilon_i)E_\alpha G + NG(\varepsilon_i)E_\alpha g](E_\alpha G)^{N-1}\, dG(\varepsilon_i)}$$

and

$$W_0 = V\mu_i - V\frac{\int_{-\infty}^{\infty} G(\varepsilon_i)(E_\alpha G)^N\, dG(\varepsilon_i)}{\int_{-\infty}^{\infty} [g(\varepsilon_i)E_\alpha G + NG(\varepsilon_i)E_\alpha g](E_\alpha G)^{N-1}\, dG(\varepsilon_i)}.$$

If all contestants are homogeneous, then the above equations simplify to[6]

$$\Delta W = \frac{V}{(N+1)\int_{-\infty}^{\infty} g(\varepsilon)G(\varepsilon)^N\, dG(\varepsilon)}$$

and

$$W_0 = V\mu_i - \frac{V}{(N+1)(N+2)\int_{-\infty}^{\infty} g(\varepsilon_i)(G(\varepsilon_i))^N\, dG(\varepsilon_i)}.$$

[6] The expression for ΔW is a specialization of eq. (47.0) in McLaughlin (1988) to the case of $N + 2$ homogeneous risk-neutral players.

Note that, unlike a tournament with only two contestants, the optimal spread depends not only on the marginal improvement in the winning probability against any other contestant ($g(\varepsilon)$ against the identical internal contestant and $E_\alpha g(\mu_i + \varepsilon_i - \mu_x)$ against each external contestant) but also on the probabilities themselves. For example, if the ability of an internal candidate is significantly below average and there is a high probability of her being outclassed by external applicants ($E_\alpha G$ is small), then marginal effort that improves her chance against her equally inept colleague or any one particular external candidate would not amount to much, so that a very strong dose of incentive (ΔW) is necessary to induce effort. The terms of the contest, therefore, depend on the abilities of existing workers relative to the population at large, with weaker internal contestants generally calling for a larger spread. This does not, however, imply that the optimal prize is necessarily smaller if their abilities are high, as ΔW also depends on $E_\alpha g'$:

$$\frac{\partial \Delta W}{\partial \alpha_i} = -\frac{\Delta W^2}{V}\frac{\partial \mu_i}{\partial \alpha_i} \times \int (E_\alpha G)^{N-2}\Big((N-1)g(\varepsilon_i)E_\alpha g + N\{g(\varepsilon_i)E_\alpha g E_\alpha G + G(\varepsilon_i)[(N-1)(E_\alpha g)^2 + E_\alpha G E_\alpha g']\}\Big)\,dG(\varepsilon).$$

In equilibrium, $\partial\mu_i/\partial\alpha_i > 0$ (see below), but the sign of the integral and therefore of the right-hand side is ambiguous. Intuitively, with above average abilities, the expected marginal increase in the winning probability with additional effort against any particular external contestant begins to decline ($E_\alpha g' < 0$), offsetting the positive incentive effect of the higher probabilities described above, so that beyond a certain level of α_i, ΔW may actually have to be increased in order to sustain effort. But if the distribution is diffuse (e.g., if g is uniform) so that $|E_\alpha g'|$ is small, then the decline in incentive with superior ability is small and we can expect the prize to decrease as the ability of the workers—and therefore their winning chances—increases relative to the external applicants.

Of more direct interest to us is the effect of opening the competition to outsiders. Ignoring the integer constraint on N, it is straightforward to show that

$$\frac{\partial \Delta W}{\partial N} = -\frac{\Delta W^2}{V}\int_{-\infty}^{\infty} (E_\alpha G)^{N-1}\{g(\varepsilon_i)\ln(E_\alpha G) + G(\varepsilon_i)(E_\alpha g)[1 + N\ln(E_\alpha G)]\}dG(\varepsilon_i);$$

$$\frac{\partial \Delta W}{\partial N} = -\frac{\Delta W^2}{V}\int_{-\infty}^{\infty} G(\varepsilon_i)^{N-1}g(\varepsilon_i)\{[1 + NG(\varepsilon_i)]\ln G(\varepsilon_i) + G(\varepsilon_i)\}dG(\varepsilon_i)$$

if all workers are homogeneous. The sign of this derivative is, in general, indeterminate: increasing the number of external candidates inevitably reduces the probability of winning for an internal contestant, but it also means that additional effort would improve her chance against external competition by more. This latter effect may result in a higher marginal return to effort that, in turn, reduces the need for a large winning spread. However, it is obvious from the above equations that the former effect will dominate as N gets "large," and we should observe the intuitive result that the introduction of external competition will necessitate an increase in the winning spread if work incentives are to be maintained at the margin.[7] With this increase in the wage spread, W_0, the wage for the losing internal candidate, also tends to decrease. It can be shown that for homogeneous contestants

$$\frac{\partial W_0}{\partial N} = \frac{(\Delta W)^2}{V} \int_{-\infty}^{\infty} g(\varepsilon_i)G(\varepsilon_i)^N \Big\{ 2N\Big[1 + \frac{N}{2} \ln G(\varepsilon_i)\Big] + 3[1 + N \ln G(\varepsilon)] + 2 \ln G(\varepsilon) \Big\} dG(\varepsilon),$$

which again is negative for large N.

And herein lies the problem with this contract. While the structure of the contest allows free manipulation of the wage spread to induce efficient effort, even to the extent that W_0 is negative (which amounts to an entry fee levied on the internal contestants), the introduction of external competition raises a moral hazard problem that limits the effectiveness of the solution. Since the total payment for a winning internal contestant $(W_0 + \Delta W)$ is likely to be above her marginal product, and only a competitive wage needs to be paid for an external recruit in the following period, the firm has the incentive to cheat an internal contestant of her victory even if she wins. The larger the number of competitors, the wider the wage spread, and the greater would be the firm's incentive to cheat. As the winner can win by virtue of a small margin in this contest, false claims by the firm are particularly difficult to verify by the workers. Although such opportunistic behavior may be constrained by the firm's concern for its reputation and the risk of disillusioning its own workers, the existence of the incentive reduces the acceptability of a contest that promises a large prize for the rather remote chance of winning in a crowded field, particularly for those with below average abilities.

Yet another problem with a large wage spread is the potentially disrup-

[7] It can be shown that, under certain conditions, ΔW approaches ∞ as N approaches ∞. These sufficient conditions are discussed in n. 9 in McLaughlin (1988).

tive "industrial politics" discussed in Lazear (1989). While, by itself, a larger prize induces greater effort from the internal candidates, it may also encourage aggressive behavior and even sabotage of the opponents' productivity in order to gain an edge in the contest. Such tactics are obviously not in the interest of the firm, the output of which depends on the products of all internal workers.

Because of these considerations, it is likely that the wage spread in many contests is below the unconstrained optimum derived above, which can result in suboptimal effort. Another incentive device is needed, and very often it is found in the form of a competitive handicap for existing workers in a contest with external applicants.

III. Contest with Constrained Wage Spread and Competitive Handicap for Internal Contestants

Suppose the wage spread is fixed at some $\Delta\tilde{W} < \Delta W$, the optimal spread derived in Section II. Suppose also that the firm awards the internal contestants a competitive handicap, h, in their contest with external contestants. The idea is to compensate for the reduction in the prize by raising the probability of winning for the internal contestant so as to maintain incentives. The value of h, however, is not constrained a priori to be positive. Given these assumptions, the firm's problem can be reformulated as follows:

$$\max_{\tilde{W}_0,h} \int U_i dG(\varepsilon_i) = \tilde{W}_0 + \Delta\tilde{W} \int G(\mu_i + \varepsilon_i - \mu_j)\left\{\int G[\mu_i + \varepsilon_i + h - \mu_x(\alpha_x)]dF(\alpha_x)\right\}^N dG(\varepsilon_i) - C(\mu_i, \alpha_i),$$

subject to

$$\tilde{W}_0 + \left[\int G(\mu_i + \varepsilon_i - \mu_j)(E_\alpha\tilde{G})^N dG(\varepsilon_i)\right]\Delta\tilde{W} = V\mu_i$$

and

$$\mu_i \in \operatorname{argmax}\left(\int U_i dG(\varepsilon_i) = W_0 + \left\{\int G(\mu_i + \varepsilon_i - \mu_j)(E_\alpha\tilde{G})^N dG(\varepsilon_i)\right\}\Delta\tilde{W} - C(\mu_i, \alpha_i)\right)$$

for $i = 1, 2$ and $j \neq i$, and $E_\alpha\tilde{G}$ is now $\int G[\mu_i + \varepsilon_i + h - \mu_x(\alpha_x)]dF(\alpha_x)$, an internal contestant's chance of winning against a randomly picked external candidate, given the handicap. As before, the second constraint can be rewritten as

$$\Delta\tilde{W}\int\{g(\mu_i+\varepsilon_i-\mu_j)(E_\alpha\tilde{G})^N+NG(\mu_i+\varepsilon_i-\mu_j)(E_\alpha\tilde{G})^{N-1}E_\alpha\tilde{g}\}dG(\varepsilon_i)$$
$$= C_1(\mu_i,\alpha_i), \tag{2}$$

where $E_\alpha\tilde{g} = \int g[\mu_i + \varepsilon_i + h - \mu_x(\alpha_x)]dF(\alpha_x)$. Substituting the zero expected profit constraint into the objective function and maximizing it subject to the workers' behavior represented in (2) gives the familiar result that

$$(V - C_1)\partial\mu/\partial x = 0, \tag{3}$$

where $x = \tilde{W}_0, h$. In other words, the contract $(\tilde{W}_0, h)$, just as $(W_0, \Delta W)$ derived in the last section, is efficient.

While it may seem intuitive that h should be positive given the constraint on the wage spread, it is the expected marginal rather than total return to effort that is being held constant if efficiency is to be achieved, and that condition alone does not guarantee a positive handicap for the internal contestants. Consider again the left-hand side of (2), which must equal V in equilibrium. Suppose we are initially in a situation in which the constraint on ΔW is just becoming binding, so that $\Delta\tilde{W} = \Delta W$, $h = 0$, and $E_\alpha\tilde{G} = E_\alpha G$. Tightening the constraint on $\Delta\tilde{W}$ a little further will require an adjustment in h to maintain the marginal benefit of effort equal to V. Totally differentiating the left-hand side of (2) and rearranging gives

$$\left.\frac{dh}{d\Delta\tilde{W}}\right|_{h=0} = \frac{-\int[g(\varepsilon_i)(E_\alpha G)^N + NG(\varepsilon_i)(E_\alpha G)^{N-1}(E_\alpha g)]dG(\varepsilon_i)}{\Delta\tilde{W}\int N(E_\alpha G)^{N-1}\left\{g(\varepsilon_i)(E_\alpha g) + G(\varepsilon_i)\left[\frac{(N-1)(E_\alpha g)^2}{E_\alpha G} + E_\alpha g'\right]\right\}dG(\varepsilon_i)}.$$

The term $E_\alpha g'(\mu_i + \varepsilon_i - \mu_x)$, and therefore the denominator, is of indeterminate sign, so that the competitive handicap may go either way. However, if either (*a*) N is "large" or (*b*) α_i is not too large, then $dh/d\Delta\tilde{W} < 0$, and we obtain the expected result of a positive handicap awarded to offset a smaller prize.

While seemingly contrived, these conditions actually have intuitive interpretations. The ambiguity in the sign of h arises again because at high levels of ability of internal contestants (when $E_\alpha G$ tends to be large, and $E_\alpha g'$, negative, except for extreme values of ε_i), the wage spread has relatively small marginal incentive effect, particularly when there are few external contestants. When external competition seems not to be a serious threat, and whatever extra effort is exerted will be matched by the other internal contestant, a large wage differential is necessary to induce effort. With ΔW constrained, incentives must be maintained by raising the marginal return to effort. In this case, the efficient solution may take the form of a handicap to the *external* contestants ($h < 0$). By putting the weaker external challengers back into the competition, the firm can induce the internal contestants to work harder, up to the efficient level. This is actually the promotion policy we observe in some top research universities, where junior faculty members fresh out of school are almost never given tenure unless they are exceptionally talented and obviously superior to outside applicants: simply being better is not quite good enough. While universities are not exactly profit maximizers, and universities and firms alike leave positions unfilled rather than hire inferior external applicants over internal candidates, the need to induce effort by lowering the probability of promotion is relevant when the existing workers are very strong. The actual practice may then take the form of a competition against a standard which is set relative to (and, in this case, higher than) the expected quality of the external applicants. But with the contest at more competitive levels, and the number of external contestants reasonably "large," the chance of winning is realistically low so that reducing the winning prize would generally have to be compensated for by a positive handicap for the internal candidates. In such a case, the more binding the constraint on the wage spread, the larger the handicap that must be awarded, and the larger will be the difference in ability between a successful external recruit and the losing internal contestants.

Existing employees are usually protected not only against the superior quality of external competitors but also against quantity as well, as equation (2) implies that

$$\frac{\partial h}{\partial N} = \frac{-\int (E_\alpha \tilde{G})^{N-1}\{g(\varepsilon_i)\ln(E_\alpha \tilde{G}) + G(\varepsilon_i)(E_\alpha \tilde{g})[1 + N\ln(E_\alpha \tilde{G})]\}dG(\varepsilon_i)}{\int N(E_\alpha \tilde{G})^{N-1}\left\{g(\varepsilon_i)(E_\alpha \tilde{g}) + G(\varepsilon_i)\left[\frac{(N-1)(E_\alpha \tilde{g})^2}{E_\alpha \tilde{G}} + E_\alpha \tilde{g}'\right]\right\}dG(\varepsilon_i)}.$$

The sign of the derivative is again ambiguous, but under conditions similar to those for which $\partial h/\partial \Delta \tilde{W}|_{h=0} < 0$, which can be considered to be the normal case, $\partial h/\partial N > 0$, and for similar reasons: unless the incentive effect is declining sharply at the margin, a more crowded field of competitors would usually call for a larger wage spread that, in the presence of constraints on ΔW, would have to be compensated for by a positive competitive handicap.

The implications of a handicap are particularly interesting for firms with workers of relatively low quality. From equations (2) and (3), it can be seen that h and μ_i enter symmetrically in the first-order conditions, μ_i being a function of α_i. It can then be easily shown that

$$\frac{\partial h}{\partial \alpha_i} = -\frac{\partial \mu_i}{\partial \alpha_i} = \frac{C_{12}}{C_{11}} < 0$$

according to our assumptions and efficiency condition. Thus, other things being the same, less able workers are given a larger handicap to keep them from giving up altogether, particularly in occupations in which workers are more directly competitive with others outside the firm (i.e., N is large). It is paradoxical that it is exactly in these firms, in which the workers seem to be more vulnerable to external competition, that a compressed wage scale can actually result in a higher probability of internal promotion than otherwise. While the handicap does not guarantee winning by internal contestants, such a system does tend to shield a weak work force from competition. Therefore, we would expect firms with constraints that dictate such institutionalized internal career structures to invest much more in the initial screening process at the entry level in order to minimize efficiency loss, as rents can often be increased with better matching between jobs and ability of workers. Also, because a worker's pay each period includes a base wage (W_0) as well as amortization of prizes won earlier, it is possible that toward the end of her career her pay is higher than both her marginal product and her reservation wage, so that there is a tendency for the worker to stay beyond the optimum retirement age. As a result, we may observe more rigid mandatory retirement policies in these firms, as they are useful also as a means of damage control in case too many inferior but lucky internal candidates get promoted. This model therefore offers a different but related interpretation for mandatory retirement as discussed in Lazear (1979).

Another implication of the model is that the magnitude of the handicap should be different at different levels of the firm's hierarchy. At the bottom of the ladder, the number of competitive external contestants is usually large and the average quality of the internal candidates relatively low, so that a positive and relatively large handicap may be necessary to induce effort. However, at more senior levels, we would expect the survivors, whether internally promoted or externally recruited, to be of higher caliber and the number of potential internal and external competitors to be smaller, so that the handicap in further contests should also be smaller and may even be negative at the top of the pyramid. This means that internal employees promoted to high positions are more likely to have won on the basis of their ability rather than "favoritism" by the employer.

It should be emphasized that the competitive handicap in this model does not arise from a desire to level the field so that weaker internal candidates can have a better chance against higher-quality external candidates. In fact, even if all workers are homogeneous and all contracts are equally efficient at inducing effort, so that $\mu_i = \mu_x$, a positive handicap for internal contestants would still be optimal if the number of external contestants, N, is large (and the conditions discussed above are satisfied). It is moral hazard and "industrial politics," which limit the use of the wage spread as an incentive device, that necessitate a handicap in the contest. Extending the analysis to risk-averse workers will only reinforce the results, given the lower uncertainty in income and easier monitoring in a contract with an implicit handicap clause. Surely by using both the wage spread and the competitive handicap the firm can more flexibly adapt the incentive system to the preference of the workers. In that sense, the wage spread and the competitive handicap are complements rather than substitutes in the design of optimal contests.

IV. Conclusion

In this article, the choice between internal promotion and external recruitment is analyzed within the framework of an economic contest. It is shown that, just as in the basic model of tournaments, efficient effort by existing employees can be induced by manipulating the wage spread, even in the face of more extensive competition from external candidates. However, the practicability of a fair contest with an augmented prize is questionable when one considers the problems of moral hazard and nonproductive competition that it induces. Nor can it explain the observation that external workers are usually recruited only if they are significantly superior to existing ones. Accordingly, an alternative efficient tournament structure is suggested in which an implicit competitive handicap is given to internal contestants when the wage spread is artificially constrained. By offering a higher chance of success, the incentive to extend effort is preserved at the margin despite an inefficiently small prize. This indicates that there is more rationality than is apparent in favoritism observed in many personnel decisions. Yet, one interesting implication of the model is that the handicap can cut both ways, depending on the quality of existing workers. While inferior internal contestants often enjoy a positive handicap, which prevents them from giving up altogether, those of high abilities may instead find the contest rigged against them to prevent an effortless win. Another implication is that the magnitude of the handicap may differ at different levels of an organization, diminishing as one moves up the hierarchy. These testable hypotheses will hopefully be pursued in future empirical analyses.

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