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A model for employer's decision for recruitment

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ABSTRACT

This paper presents a theoretical and empirical analysis of the decision and how it relates to wage setting and the provision of general training. The theoretical framework is a promotion tournament involving M competing firms with heterogeneous productivities, two-level job hierarchies, and a fixed number of managerial positions. This paper also considers an alternative model based on variation in the quality of the worker-employer match. Both models predict the following results: As the number of workers at the lower level of the hierarchy increases, holding fixed the number of managers at the top, 1) internal promotion increases relative to external recruitment, 2) employers provide more general training, 3) the percentage of employees in the upper tail of the wage distribution decreases, 4) profitability increases. This paper tests these predictions using data from the 2017 wave of the Workplace Employee Relations Survey, a nationally-representative cross section of Indian establishments. The empirical results are supportive and contribute to the literature some new stylized facts concerning how key employer decisions vary with both the size and shape of the organizational hierarchy.

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INTRODUCTION

The number of managerial positions is limited in most organizations, and employers fill those limited positions with either internal hires or external recruits. This external-versus-internal-hiring decision is important, because managerial capability is a critical determinant of the profitability of an organization. This paper objective is to explore how this decision is related to the shape of the organizational hierarchy, presenting a new theoretical model that describes the interconnections among employers' competition for scarce managerial talent, their profitability, the shape of their organizational hierarchy, the distribution of wages within the organization, and their incentives to train workers. This paper model delivers testable implications concerning how these concepts are related, and this paper test these predictions empirically using the Indian workplace employee relations survey (WERS), a large-scale, nationally-representative, cross section of employers surveyed in 2017. This paper results support each of the model's predictions and introduces a new set of empirical results to the literature on internal hiring versus external recruitment. This paper finds that, controlling for employer characteristics, increases in establishment size that make the job hierarchy more "bottom heavy" are associated with: 1) a greater likelihood of

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hiring internally versus recruiting externally, 2) a higher level of profit, 3) a lower fraction of workers in the upper tail of the organization's wage distribution, and (4) a greater likelihood of providing training to workers. This paper analysis contributes to the theoretical and empirical literatures on promotions in general and internal hiring versus external recruitment in particular. Given that two important functions of promotions are creating worker incentives and assigning workers to jobs, the two main building blocks for theoretical analyses of promotions are tournament models and job assignment models (Baker, Jensen, and Murphy, 1988; Gibbons and Waldman, 1999a). This paper is a job-assignment model that incorporates a central feature of tournament models, namely a hierarchy with a fixed number of managerial positions. The notion of fixed job slots is an important feature of most within-firm job hierarchies, as discussed in DeVaro (2006), so it is worth while exploring the job-assignment aspect of promotions under the realistic assumption of fixed managerial job slots. Furthermore, an important distinguishing feature of model is that, unlike most existing models of promotion, this paper explicitly analyzes strategic interactions among heterogeneous employers in their efforts to fill their managerial positions with capable candidates. In this paper model, firms' hierarchical structures are endogenously determined, where firms with higher returns from their managers adopt more bottom-heavy hierarchical structures. This results in a set of novel testable predictions concerning internal promotion versus external recruitment and the shape of the job hierarchy. To see the model's main ideas, consider a labor market consisting of M (≥ 2) firms, each of which has a two-tier hierarchy consisting of one managerial position and a variable number of subordinate positions. The symmetric learning assumption in which a particular worker's ability is revealed during the course of his career to all employers in the labor market at the same rate has appeared in a number of models in the job assignment literature (Gibbons and Waldman 1999b, 2006). An alternative strand of the literature focuses on asymmetric learning in which a worker's current employer obtains information about his ability at a faster rate than competing employers (Milgrom and Oster 1987; Costa 1988; Waldman 1988; Bernhardt 1995; Zabojnik and Bernhardt 2001; Waldman 2004; Owan 2004; Golan 2005; DeVaro and Waldman 2012; DeVaro, Ghosh, and Zoghi 2012). This paper assumes that employers have symmetric information about managerial capability and that employers compete against each other by simultaneously making wage offers to employ one worker in the managerial position. This paper models, and an extension that incorporates firm-sponsored general training, yields the following set of testable predictions. As the number of subordinate workers at the lower level of the hierarchy increases (holding fixed the number of managers at the top): 1) internal promotion increases relative to external recruitment, 2) profitability increases, 3) the percentage of employees in the upper tail of the within-establishment wage distribution decreases, 4) employers provide more general training. The fourth prediction offers a new explanation for the existence of firm-sponsored general training, a topic of recent interest in the training literature. Alternative explanations for this practice have been offered in earlier work (Acemoglu and Pischke 1998, 1999a, 1999b). This paper analysis relates to the literature on raiding (Bernhardt and Scoones, 1993; Kim, 2007; Lazear, 2012). Lazear (2012) explored a model consisting of two firms, with a raid occurring when a worker is worth more to a competing employer than to the current employer, and demonstrated that an informational asymmetry between the two firms concerning the worker's productivity gives rise to a number of implications on raiding and offer-matching. Building on Lazear's model, Kim (2007) explored a model that links employee movement and product-market competition, demonstrating that a firm may poach its rival's key employees in order to induce the rival's exit. Bernhardt and Scoones (1993) examined the strategic promotion and wage decisions of employers when employees may be more valuable to competing firms. In all of these models, the fundamental driving force for raiding is the quality of worker-employer match. In contrast, this paper models the driving force for raiding is the combination of fixed managerial job slots and employers' heterogeneity in their returns from managerial capability, though, as in the models based on match quality, this paper model also captures the idea that raiding occurs when a worker is worth more to a competing employer than to his current employer. In Materials and Methods section, this paper presents an alternative model based on

match quality that yields the same predictions as main model, and this paper discusses how both models compare. In this paper main model, returns from managerial capability are assumed to be different across firms. A similar assumption was made by Zábojník and Bernhardt (2001), which proposed an asymmetric learning model in which tournament prizes are determined competitively. That analysis incorporated firm heterogeneity by assuming a fixed number of high-productivity firms and free entry of low-productivity firms. As in this paper model, high-productivity firms in their model adopt a more bottom-heavy hierarchical structure than low-productivity firms in the equilibrium. However, the Zábojník and Bernhardt (2001) model does not yield predictions concerning internal promotion versus external recruitment; there is no labor turnover in the equilibrium, and all promotions are internal in their model. This paper model also predicts that an employer with a more bottom-heavy hierarchical structure makes more profit, has a greater fraction of workers appear in the upper tail of the firm's wage distribution, and provides more training. Although these additional predictions also arise from the Zábojník and Bernhardt (2001) analysis, this paper work offers a contribution in two ways (apart from our unique theoretical prediction concerning internal hiring). First, this paper model establishes the robustness of these additional predictions in the context of a model with a very different focus; whereas Zábojník and Bernhardt (2001) focus on the incentive mechanisms of promotions with asymmetric learning, this paper focus on the job-assignment mechanisms of promotions with symmetric learning. Second, whereas the Zábojník and Bernhardt (2001) analysis is purely theoretical, this paper empirically test all of model's predictions. Another purely theoretical analysis that relates is Demougin and Siow (1994), which incorporates training in a similar manner to the extension of main model. Demougin and Siow (1994) consider an overlapping-generations structure in which firms are infinitely lived and each cohort of workers participates in the labor market for two periods. A fundamental difference between the Demougin and Siow (1994) model and this paper is that in theirs the equilibrium hierarchical structure (bottom-heaviness) is the same across firms, whereas in this paper it is different. This is crucial, because the focus of this paper analysis is on deriving and empirically testing new predictions concerning how variation in hierarchical structures across firms affects the likelihood of internal promotion, profitability, wage structure, and training intensity. Other theoretical analyses of internal hiring include Chan (1996) and Waldman (2003), and a recent empirical analysis is Chan (1996). These analyses differ from in their motivations and in that they do not focus on the implications of employer heterogeneity. In particular, they aim to explain why internal candidates are frequently preferred for promotion over equally-qualified external candidates. Chan's (1996) model consists of two *ex-ante* identical risk-neutral firms, while Waldman (2007) model considers a single risk-neutral firm. In contrast, this paper study focuses on the implications of employer heterogeneity in the returns from managerial capability, and this yields a set of new predictions concerning how a firm's tendency to hire internally, its profitability, its within-firm wage distribution, and its decisions regarding training relate to its chosen shape of the job hierarchy. Before presenting main model in the next section, this paper note that theory offers a potential explanation for a well-established empirical finding that internal hiring of CEOs is more prevalent than external recruitment in large firms (Lauterbach and Weisberg, 1994; Parrino, 1997; Agrawal,. Murphy, 1999; Charles, and Tsoulouhas, 2006; Lauterbach and Weisberg, 2014). Although this "internal succession – firm size" relationship has been documented empirically, to knowledge, no theoretical models have been proposed that yield this prediction. This paper model's first prediction relates to this stylized fact, though this paper emphasize that this paper prediction pertains to changes in size of a particular type, namely increases in size at the lower (i.e. non-managerial) levels of the hierarchy. Thus, increases in firm size in model also imply changes in the shape of the hierarchy, in particular a flattening of the hierarchy or an increase in "bottom heaviness". However, the empirical regularity pertaining to firm size in general might well be consistent with the predictions of model to the extent that "firm size" in general is positively correlated with size in the lower levels of the hierarchy, and thus model can be interpreted as offering a theoretical explanation for the "internal succession – firm size" relationship for CEOs. Whereas the previous empirical studies simply focused on firm

size without distinguishing how this size was distributed across hierarchical levels, the data used allow to investigate empirically the more refined prediction regarding size (and shape) from theoretical model. This paper finds clear support for this prediction, thereby introducing a new stylized fact to the literature as well as a theoretical rationale for it.

MATERIALS AND METHODS

A model of internal promotion versus external recruitment

In the following subsections model is presented, analysis, testable predictions, and an extension to consider employer-sponsored training.

Model

Consider an industry consisting of M (≥ 2) firms in a two-period setup. Heterogeneous firms are characterized by parameters V_i, where i indexes firms and $V_1 > V_2 > \ldots > V_M$. The parameter V_i determines firm i's return from its manager, as described later. For simplicity, it is assumed that every employer knows its own V and those of the other employers in the market. In the beginning of period 1, a large number of identical individuals exist. Every firm i (= 1, 2, …, M) simultaneously makes take-it-or-leave-it first-period wage offer $w_i^1 > 0$ individuals. If an individual accepts firm i's offer, he is employed by firm i in period 1. Let n_i denote the number of firm i's first-period employees (call them young workers). If an individual is not employed by a firm, he becomes self-employed. To simplify the description of the model, assume that such an individual stays self-employed until the end of period 2, earning w > 0 per period. Every young worker is assigned to a subordinate position. Due to lack of experience, each young worker requires supervision from the employer. Assume that each firm i's young worker's output is $\eta - s(n_i)$, where $\eta > 0$ is a given constant and s(.) is a differentiable function with s'(.) > 0. That is, as the number of young workers increases, each young worker's output declines because each young worker receives less supervision from the employer. To simplify the analysis, let s(Z) = bZ where b > 0. This paper allows the possibility that a young worker's output is negative. This can be avoided by interpreting η to be each young worker's (positive) output and $s(n_i)$ to be a per-worker supervision cost that firm i must incur in period 1 when it employs n_i young workers. At the end of period 1, each young worker j exhibits managerial capability m_j, which is randomly drawn from a uniform distribution between α and β, $0 \leq \alpha < \beta$. To keep the analysis simple and the notation compact, let α = 0 and β = 1. If worker j is assigned to a subordinate position, his second-period output is $y \geq \eta$, requiring no supervision from the employer. Each worker's productivity is completely transferable across firms in the market, and the realization of each worker's managerial ability is observable by all M firms. In period 2, each firm can fill one managerial position and an unlimited number of subordinate positions. Each firm's gross output from its manager is given by $V_i(m_i + q)$, where m_i denotes the managerial capability of the manager in firm i, and q denotes firm i's manager's productivity if he has zero managerial capability. Assume $V_M > y/q$, which implies that each firm's gross output from any worker is higher when the worker is assigned as a manager than when he is assigned as a subordinate. Each firm's period-2 gross output is then given by $V_i(m_i + q) + n_i^O y$, where n_i^O denotes the number of firm i's subordinates (the superscript "O" stands for old workers) in period 2. Firm i's overall profit is the gross output minus wage bills.

The timing of the game can be summarized as follows:

Stage 1: Every firm i (= 1, 2, …, M) simultaneously makes take-it-or-leave-it first-period wage offer $w_i^1 > 0$ individuals. Individuals that are not employed by a firm become self-employed.

Stage 2: Each young worker exhibits managerial capability, m_j, which is a random draw from a uniform distribution between α and β. The realization of each worker's managerial capability is common knowledge.

Stage 3: Each firm i simultaneously makes wage offers, denoted w_{ir}, to every young worker r (including the workers employed at other firms). Each worker chooses the highest wage offer, and in case of a tie stays with his current employer. Each firm then assigns one worker to its managerial position and all others to subordinate positions. Finally, each firm realizes output.

Equilibrium and analysis

This paper now derives sub game perfect nash equilibrium in pure strategies. To focus analysis and simplify the description of the results, it is assumed

that an old worker's second-period output, y, is sufficiently high so that every firm employs at least one young worker in period 1 in the equilibrium. A sufficient condition for this is $y > 2(w + b) - \eta$, which it is assumed throughout our analysis. Suppose that firm i employs n_i young workers at the first-period wage w_i. If a young worker is assigned to a subordinate position in period 2, his second-period output is y, and hence Bertrand wage competition implies that the worker's second-period wage is y. Also, if a young worker is assigned as a manager, the worker's second period wage is at least y. This implies that $w_i \leq 2w - y$, given that any individual can earn w per period by choosing self-employment. Hence, firm i's period-1 profit is at least $n_i[\eta - bn_i - (2w - y)] = n_i[y + \eta - 2w - bn_i]$, which is maximized when $n_i = (y + \eta - 2w)/2b$. Then, $(y + \eta - 2w)/2b > 1 \Leftrightarrow y > 2(w + b) - \eta$ guarantees that every firm employs at least one young worker in any equilibrium of the game. Note that this paper focus on equilibria: that is, in equilibrium, every firm employs all individuals to whom it made a first-period wage offer. Suppose that each of the M firms employs at least one young worker at stage 1. Let N (≥ M) denote the total number of young workers in the market and m (k|N) (k = 1, 2, …, N) denote the k^{th} highest realization of managerial capability in the market, across the young workers in all M firms. It can be shown that, in the equilibrium of the subsequent Stage 3 subgame, each firm i employs a worker with m (i|N) as its manager at the wage of w_i^m (N) as Eq. 1:

Where:

$$w_i^m(N) = y + \sum_{\psi=i}^{M-1} V_{\psi+1}[m(\psi \mid N) - m(\psi+1 \mid N)] \text{ for } i = 1, 2, \ldots,$$

M – 1, and $w_M^m(N) = y$. (1)

This result can be explained as follows. Since firm 1 has the highest return from its manager, it hires the worker with m (1|N), the highest realization of the managerial capability, and firm 2 hires the worker with m(2|N), and so on. This paper finds that w_1^m (N) = w_2^m (N) + V_2 [m(1|N) – m(2|N)] holds in the equilibrium. Note that V_2[m(1|N) – m(2|N)] captures the increment of firm 2's gross profit by hiring the worker with managerial capability m(1|N) instead of the worker with capability m(2|N) as its manager. The minimum amount that firm 1 must offer above and beyond the wage w_2^m (N) to prevent firm 2 from successfully hiring the worker with managerial capability m (1|N) is V_2[m(1|N) – m(2|N)]. Similarly, it is find $w_i^m(N) = w_{i+1}^m(N) + V_{i+1}[m(i|N) - m(i+1|N)]$ for all i = 1, 2, …, M – 1. This provides an explanation for (1). Each firm's Stage-3 profit from its manager in the subsequent equilibrium, denoted π_i^m (N), is as Eq. 2;

$\pi_i^m(N) = V_i[m(i|N) + q] - w_i^m(N)$, which gives

$$\pi_i^m(N) = \sum_{\psi=i}^{M-1}(V_\psi - V_{\psi+1})m(\psi \mid N) + V_M m(M \mid N) + V_i q - y$$

for i = 1, 2, …, M – 1, and

$$\pi_M^m(N) = V_M m(M \mid N) + V_M q - y. \quad (2)$$

Concerning other workers who are not assigned to managerial positions, Bertrand wage competition implies that each firm retains its first-period workers at the wage of y, making zero profits from them. The expected value of each firm i's period-2 profit is then E [π_i^m(N)]. Given the assumption of a uniform distribution for managerial capability founded as Eq. 3:

$$E[\pi_i^m(N)] = \sum_{\psi=i}^{M-1}(V_\psi - V_{\psi+1})\frac{N-(\psi-1)}{N+1} + V_M\frac{N-(M-1)}{N+1} + V_i q - y$$

for i = 1, …, M–1,

and $E[\pi_M^m(N)] = V_M\frac{N-(M-1)}{N+1} + V_M q - y$. (3)

Now, suppose that there exists an equilibrium in which each firm i offers $w_i^{1^*}$ individuals and employs young workers at Stage 1. Let $N^* \equiv \sum_{i=1}^{M} n_i^*$. In the equilibrium, each young worker becomes firm i's (i = 1, 2, …, M) manager and earns second-period wage $w_i^m(N^*)$ with probability $1/N^*$, and remains a subordinate of his first-period employer earning second-period wage y with probability $(N^* - M)/N^*$. Each young worker's expected second-period wage in the equilibrium is then given by $w^2(N^*)$ as Eq. 4:

Where:

$$w^2(N) \equiv \frac{\sum_{i=1}^{M} E[w_i^m(N)]}{N} + \frac{N-M}{N}y = y + \frac{\tilde{V}}{N(N+1)}, \quad (4)$$

Where: $\tilde{V} \equiv \sum_{i=1}^{M-1} iV_{i+1}$.

At Stage 1, each individual receives at most one first-period wage offer in the equilibrium, and every individual who receives an offer is indifferent between taking and not taking the offer. Since a self-employed individual's lifetime wage is 2w, it has that

$w_i^{1*} + y + \frac{\widetilde{V}}{N^*(N^*+1)} = 2w$ holds for all i = 1, 2, …, M, and hence $w_i^{1*} = w^1(N^*)$ for all i = 1, 2, …, M, as Eqs. 5 and 6:
Where:

$$w^1(N) \equiv 2w - y - \frac{\widetilde{V}}{N(N+1)}. \quad (5)$$

Then each firm i's expected overall profit is $\Pi_i(n_i^*, N_{-i}^*)$ in the equilibrium as Eq. 6.
Where:

$$\Pi_i(n_i, N_{-i}) \equiv E[\pi_i^m(n_i + N_{-i})] + n_i[\eta - bn_i - w^1(n_i + N_{-i})] \quad (6)$$
$$= E[\pi_i^m(n_i + N_{-i})] + n_i[y + \eta - 2w + \frac{\widetilde{V}}{(n_i + N_{-i})(n_i + N_{-i} + 1)} - bn_i]$$

Where:
$N_{-i} \equiv \sum_{j \neq i} n_j$ and $N_{-i}^* \equiv \sum_{j \neq i} n_j^*$. We have

$$\frac{\partial}{\partial n_i}\Pi_i(n_i, N_{-i}) = \frac{\ddot{V}_i N^2 + \widetilde{V}[N^2 + N - (2N+1)n_i]}{N^2(N+1)^2} + y + \eta - 2w - 2bn_i$$

for i = 1, 2, …, M,
Where:

$$\ddot{V}_i \equiv iV_i + V_{i+1} + V_{i+2} + \ldots + V_M \text{ for i = 1, 2, …, M – 1, and } \ddot{V}_M \equiv MV_M. \quad (7)$$

Treating the number of workers as a continuous variable, Eq.7, gives us necessary first order conditions for the equilibrium numbers of each firm i's young workers to satisfy. That is:

$\frac{\partial}{\partial n_i}\Pi_i(n_i^*, N_{-i}^*) = 0$ must hold for all i = 1, 2, …, M.

Testable predictions

This paper now derives testable predictions that serve as the basis for empirical tests. In the equilibrium, each firm i has n_i^* young workers, and all of them are assigned to subordinate positions. There are N^* young workers in the market, and every young worker has an equal probability $1/N^*$ to become firm i's (i = 1, 2, …, M) manager in period 2. Hence, the expected number of firm i's subordinates in Period 2 in the equilibrium is $[(N^* – M)/N^*]n_i^* \equiv n_i^{O*}$, and $n_1^* > n_2^* > \ldots > n_M^*$ implies $n_1^{O*} > n_2^{O*} > \ldots > n_M^{O*}$. Firms in this model adopt two-tier hierarchies, consisting of a manager at the higher hierarchical level and subordinates at the lower hierarchical level. Then, $n_1^* > n_2^* > \ldots > n_M^*$ and $n_1^{O*} > n_2^{O*} > \ldots > n_M^{O*}$ mean that firm 1 adopts the most "bottom-heavy" hierarchical structure, firm 2 is the second most bottom-heavy, and so on. In results and discussion, this paper describes how a measure of hierarchical bottom-heaviness can be constructed in data set. The following four testable predictions emerge from model.

Testable prediction 1: An employer with more bottom-heavy hierarchical structure is more likely to hire its manager from its internal candidates.

Testable prediction 2: An employer with more bottom-heavy hierarchical structure makes more profit.

Testable prediction 3: An employer with more bottom-heavy hierarchical structure has a lower percentage of its employees located in the upper tail of the within-firm wage distribution.

Testable prediction 4: An employer with a more bottom-heavy hierarchical structure provides a higher level of general training to its employees.

An alternative model: Managerial match quality

In this model, stochasticity in managerial capability plays an important role in inducing external recruiting. In an alternative model, the stochastic component might instead represent firm-specific managerial match quality. To explore such an alternative model, consider the two-firm case (M = 2). Suppose that if firm 1 employs young worker k in period 1, worker k's match quality with firm 1, denoted m_{k1}, is realized by both firms and by the worker at the end of period 1. However, worker k's match quality with firm 2, m_{k2}, is still unknown to both firms and to the worker. Assume that m_{k1} and m_{k2} are both randomly drawn from a uniform distribution between 0 and 1, where each worker's match quality with firm 1 is independent of his match quality with firm 2. If firm i employs worker k as its manager, firm i's gross output from that manager is $V_i(m_{ki} + q)$. The other specifications of the model are the same as in this paper original model. This paper now derives sub game perfect nash equilibrium in pure strategies of this alternative model, assuming throughout that an old worker's second-period output as a subordinate, y, is sufficiently high so that each firm employs at least two young workers in period 1 in the equilibrium. A sufficient condition for this is $y > 2(w + 2b) – \eta$, which it is assumed throughout analysis. Suppose that there exists an equilibrium in which each firm employs at least two young workers (that is, $n_i \geq 2$, i = 1, 2) at stage 1. Let $m_i(1|n_i)$ denote the highest realization of match quality among firm i's n_i young workers. If firm i employs one of firm j's ($j \neq i$) young workers as its

manager, the manager's expected match quality with firm i is 1/2. This implies that each firm i employs the worker with $m_i(1|n_i)$ as its period-2 manager at the wage y if $m_i(1|n_i) \geq 1/2$, and employs one of firm j's ($j \neq i$) young workers as its period-2 manager at the wage of y if $m_i(1|n_i) < 1/2$. Hence, the expected match quality of each firm i's period-2 manager in the equilibrium is g (n_i) as Eqs. 8 and 9:
Where:

$$g(n) \equiv \int_0^{1/2} \frac{1}{2} n z^{n-1} dz + \int_{1/2}^{1} z n z^{n-1} dz = \frac{n + (1/2)^{n+1}}{n+1}, \quad (8)$$

and each firm i's expected profit from its period-2 manager in the equilibrium is

$$V_i(g(n_i) + q) - y. \quad (9)$$

For workers who are not assigned to managerial positions, Bertrand wage competition implies that each firm retains its first-period workers at the wage of y, making zero profits from them. Each firm i's period-2 expected profit is then $V_i(g(n_i)+q)-y$. At stage 1, each individual anticipates that, if is employed by a firm, second-period wage will be y. Hence, each firm i employs n_i young workers at the wage of 2w – y at stage 1 in the equilibrium, and each firm i's expected overall profit in the equilibrium is $\pi_i(n_i)$, as Eq. 10:

Where:

$$\pi_i(n) \equiv V_i(g(n)+q) - y + n[\eta - (2w - y) - bn]. \quad (10)$$

Treating the number of workers as a continuous variable, this paper find that $\pi_i(n)$ is strictly concave for all $n \geq 1$, and that there exists a unique value $n_i^* > 0$ (i = 1, 2) satisfying $\pi_i(n_i^*) > \pi_i(n)$ for all $n \geq 1$, $n \neq n_i^*$, where $V_1 > V_2 \Rightarrow n_1^* > n_2^*$. This implies the result analogous to Proposition 1 of our original model: that is, the alternative model has a unique equilibrium in which each firm i employs n_i^* individuals in period 1, where $n_1^* > n_2^* > 2$. In the equilibrium, firm i employs its period-2 manager internally with probability P_i^*, as Eq. 11;

Where:

$$P_i^* = 1 - (1/2)^{n_i^*}. \quad (11)$$

Since $n_1^* > n_2^* \Rightarrow P_1^* > P_2^*$, the alternative model yields qualitatively the same prediction as *Testable prediction 1* of original model. Also, $V_1 > V_2$ and $n_1^* > n_2^*$ together imply $\pi_1(n_1^*) > \pi_2(n_2^*)$, which yields qualitatively the same prediction as *Testable prediction 2* of original model. While Testable predictions 1 and 2 of the original model also hold in the alternative model based on firm-specific managerial match quality, *Testable prediction 3* does not hold in the alternative model, because all managers and old workers earn the same wage, y, in equilibrium. This is because of assumption that firms make take-it-or-leave-it offers to workers. If it is considered an alternative wage-setting process in which an employer and its manager share the surplus associated with the employment, then the expected wage of managers will be higher than y, and this will in turn imply that the prediction 3 also holds. Furthermore, although it does not show it formally here, an extension of this alternative model could also yield our *Testable prediction 4* concerning training. In summary, the four testable implications arising from this paper model based on employer heterogeneity in the returns to managerial capability could also arise from a model based on heterogeneity in the quality of worker-employer matches. While from a theoretical standpoint the predictions can be generated from either source of heterogeneity taken alone, in the real world this paper suspects that both sources are relevant and important. It is reasonable to expect that an integrative model that incorporates both sources of heterogeneity would also yield the same four predictions, and such a model would likely be more realistic than either the model of that neglects heterogeneity in match qualities or the model that neglects employer heterogeneity in the returns to managerial capability. Nonetheless, an important result of this paper is that either heterogeneity in match quality (taken alone) or employer heterogeneity in returns to managerial capability (taken alone) is sufficient to generate the four testable implications for which this paper find empirical support in the following section.

RESULTS AND DISCUSION

Data and empirical analysis

The data source is the management questionnaire from the 2017 Indian Workplace Employee Relations Survey (WERS), jointly sponsored by the Department of Trade and Industry, ACAS, the Economic and Social Research Council, and the Policy Studies Institute. Distributed via the Indian Data Archive in November 2017, the WERS data are a nationally representative stratified random sample covering Indian workplaces with at least 5 to 9 employees, except for local units in Delhi and those in the following 2017 Standard

Table 1: Descriptive statistics

Internal hiring	Fractions	Mean	Standard error
1 = "External applicants are only source, no internal recruitment"	0.120		
2 = "External applicants are given preference, other things being equal, over internal applicants"	0.010		
3 = "Applications from internal and external applicants are treated equally"	0.656		
4 = "Internal applicants are given preference, other things being equal, over external applicants"	0.211		
5 = "Internal applicants are only source, no external recruitment"	0.003		
Financial Performance			
1 = a lot below industry average	0.006		
2 = below industry average	0.094		
3 = at industry average	0.396		
4 = above industry average	0.399		
5 = a lot above industry average	0.104		
Financial Performance (interpreted as "profit")			
1 = a lot below industry average	0.002		
2 = below industry average	0.105		
3 = at industry average	0.371		
4 = above industry average	0.395		
5 = a lot above industry average	0.127		
Off-Job Training			
1 = "None, 0%"	0.251		
2 = "Just a few, 1-19%"	0.151		
3 = "Some, 20-39%"	0.099		
4 = "Around half, 40-59%"	0.084		
5 = "Most, 60-79%"	0.071		
6 = "Almost all, 80-99%"	0.057		
7 = "All, 100%"	0.288		
Induction Training		0.776	0.017
Fraction High Wage		0.091	0.007
Managers		4.479	0.160
Managers and Senior Officials		3.045	0.105
Professionals		1.437	0.087
Subordinates		25.148	0.826
Associate Professional and Technical		3.237	0.204
Administrative and Secretarial Occupations		4.460	0.220
Skilled Trades		2.300	0.141
Caring, leisure, and personal service		2.301	0.162
Sales and customer service		5.085	0.266
Process, Plant and Machine Operatives and Drivers		3.213	0.206
Routine Unskilled		4.617	0.274
Union		0.275	0.016
Fraction of Part Time Workers		0.333	0.012
Fraction of Temporary Workers		0.018	0.004
Percent Union		13.124	0.938
Number of Recognized Unions		0.313	0.020
Owner Manager		0.278	0.018
Foreign Owned		0.105	0.012
Age Less Than 5		0.106	0.013
Age 5 to 9		0.133	0.014
Age 10 to 14		0.148	0.014
Age 15 to 20		0.131	0.015
Age 21 to 24		0.113	0.012
Age 25 plus		0.493	0.036
Franchise		0.026	0.006
Fixed Term Percentage		5.048	0.605
Fixed Term		0.194	0.013
Temporary Workers		0.109	0.010
Private		0.896	0.010
Industry:			
Manufacturing		0.117	0.013
Electricity, Gas, and Water		0.001	0.000
Construction		0.052	0.008
Wholesale and Retail		0.269	0.017
Hotels and Restaurants		0.095	0.011
Transport and Communication		0.051	0.009
Financial Services		0.055	0.008
Other Business Services		0.135	0.013
Public Administration		0.021	0.004
Education		0.023	0.004
Health		0.115	0.010
Other Community Services		0.067	0.009
Sample Size = 2003			

Industrial Classification (SIC) divisions: agriculture, hunting, and forestry; fishing; mining and quarrying; private households with employed persons; and extra-territorial organizations. The 2017 WERS was the twelfth such survey, following earlier waves in 1980, 1984, 1990, and 1998 etc. The sampling frame used for WERS 2017 is the Inter-Departmental Business Register (IDBR) which is maintained by the Office for National Statistics (ONS). As noted by Chaplin *et al.* (2005), "The IDBR is undoubtedly the highest quality sample frame of organizations and establishments in India. The frame is continuously up-dated from VAT and PAYE records and establishments that no longer exist are removed reasonably quickly." Some of the workplaces targeted were found to be out of scope, and the final sample size of 2295 implies a net response rate of 64%, or 64.8% among establishments having 10 or more workers, after excluding the out-of-scope cases (Chaplin *et al.*, 2005). Data were collected via personal interviews of approximately 2 hours in average duration, between February 2017 and April 2017, using Computer Aided Personal Interviewing. The respondent in the management questionnaire was usually "the senior manager dealing with personnel, staff or employment relations" at the workplace. Descriptive statistics for all variables in the analysis are displayed in Table 1; it uses establishment sampling weights when computing the statistics in this table and in all of subsequent analyses.

Table 2: Ordered probit models (dependent variable = internal hiring)

	Fractions	Mean	Standard Error
Managers	-0.227	0.182	-0.105
	(0.410)	(0.462)	(0.468)
Subordinates	0.689***	0.539***	0.613***
	(0.135)	(0.174)	(0.174)
Union		0.176	0.200
		(0.127)	(0.127)
Fraction of Part Time Workers		-0.157	-0.320
		(0.185)	(0.200)
Fraction of Temporary Workers		-0.272	-0.284
		(0.224)	(0.232)
Percent Union		-0.001	-0.001
		(0.003)	(0.003)
Number of Recognized Unions		0.040	0.047
		(0.066)	(0.064)
Owner Manager		-0.292**	-0.265**
		(0.136)	(0.135)
Foreign Owned		0.162	0.098
		(0.182)	(0.178)
Age Less Than 5		0.287	0.259
		(0.180)	(0.185)
Age 5 to 9		0.038	0.028
		(0.173)	(0.178)
Age 10 to 14		0.094	0.043
		(0.127)	(0.127)
Age 15 to 20		0.053	0.044
		(0.098)	(0.098)
Age 21 to 24		0.134	0.141
		(0.180)	(0.179)
Age 25 plus		-0.003	-0.009
		(0.067)	(0.068)
Franchise		0.437	0.461
		(0.365)	(0.371)
Fixed Term Percentage		-0.000	0.001
		(0.003)	(0.003)
Fixed Term		0.117	0.083
		(0.127)	(0.137)
Temporary Workers		0.043	0.031
		(0.116)	(0.118)
Private		-0.040	-0.002
		(0.156)	(0.165)
Sample Size	1982	1694	1694

Note: Standard errors in parentheses. *, **, and
*** denote statistical significance at the 10%, 5%, and 1% levels, respectively.

Table 3: Ordered probit models (dependent variable = financial performance)

	Fractions	Mean	Standard Error
Managers	-0.017	0.203	0.071
	(0.406)	(0.515)	(0.527)
Subordinates	0.253**	0.606***	0.672***
	(0.122)	(0.195)	(0.200)
Union		-0.147	-0.138
		(0.170)	(0.168)
Fraction of Part Time Workers		-0.165	-0.147
		(0.176)	(0.192)
Fraction of Temporary Workers		-1.207*	-1.122
		(0.733)	(0.713)
Percent Union		0.001	0.001
		(0.003)	(0.003)
Number of Recognized Unions		-0.017	-0.028
		(0.061)	(0.060)
Owner Manager		0.045	0.040
		(0.113)	(0.113)
Foreign Owned		0.243	0.235
		(0.159)	(0.159)
Age Less Than 5		-0.309	-0.305
		(0.194)	(0.195)
Age 5 to 9		-0.156	-0.163
		(0.149)	(0.145)
Age 10 to 14		-0.156	-0.178
		(0.112)	(0.110)
Age 15 to 20		-0.250**	-0.248**
		(0.133)	(0.114)
Age 21 to 24		0.085	0.099
		(0.186)	(0.186)
Age 25 plus		-0.134**	-0.131**
		(0.063)	(0.061)
Franchise		-0.473	-0.449
		(0.367)	(0.371)
Fixed Term Percentage		0.003	0.004*
		(0.002)	(0.002)
Fixed Term		-0.011	-0.037
		(0.123)	(0.124)
Temporary Workers		0.021	-0.001
		(0.133)	(0.134)
Private		0.040	0.059
		(0.188)	(0.184)
Sample Size	1767	1519	1519

Note: Standard errors in parentheses. *, **, and
*** denote statistical significance at the 10%, 5%, and 1% levels, respectively.

Some of the variables in multivariate statistical models contain missing values, and this estimates all of models using list-wise deletion.

Testable prediction 1 views as the central prediction of model. It states that organizations that choose more bottom-heavy hierarchical structures are more likely to promote internally rather than recruit externally. This addresses this prediction by estimating ordered probit models that use the following WERS measure as a dependent variable:

Internal Hiring: Qualitative response to the question "Which of these statements best describes your approach to filling vacancies at this workplace?" 1 = "External applicants are only source, no internal recruitment", 2 = "External applicants are given preference, other things being equal, over internal applicants", 3 = "Applications from internal and external applicants are treated equally", 4 = "Internal applicants

Table 4: Interpretation of "Financial performance"

Which of these measures corresponds most closely to your interpretation of financial performance?	Frequency
Profit	1021
Value added	197
Sales	218
Fees	28
Budget	522
Costs	101
Expenditure	46
Stock market indicators (e.g. share price)	25
Other (please specify)	86
Total	2244

are given preference, other things being equal, over external applicants", 5 = "Internal applicants are only source, no external recruitment"

As seen in Table 2, this prediction is empirically supported in that the coefficient of Subordinates is positive and statistically significant at conventional levels. To interpret the magnitudes implied by the reported ordered probit coefficients, consider an increase of 100 in the number of Subordinates at an establishment. On average, in the most controlled specification, this change is associated with decreases in the probability that Internal Hiring = 1, 2, or 3, an increase of 1.6 percentage points in the probability that Internal Hiring = 4, and an increase of 0.04 percentage points in the probability that Internal Hiring = 5.

Testable prediction 2 states that organizations with more bottom-heavy hierarchical structures earn higher profit. To address this prediction this paper uses a

Table 5: Ordered Probit Models (Dependent Variable = Financial Performance)

	Fractions	Mean	Standard Error
Managers	0.081	0.194	-0.257
	(0.682)	(0.750)	(0.722)
Subordinates	0.359*	0.838**	1.021***
	(0.269)	(0.382)	(0.400)
Union		0.040	0.038
		(0.239)	(0.245)
Fraction of Part Time Workers		-0.459*	-0.482*
		(0.251)	(0.263)
Fraction of Temporary Workers		-0.416	-0.465
		(0.571)	(0.605)
Percent Union		-0.005	-0.005
		(0.005)	(0.005)
Number of Recognized Unions		-0.017	-0.019
		(0.061)	(0.245)
Owner Manager		-0.081	-0.083
		(0.138)	(0.138)
Foreign Owned		0.333	0.291
		(0.217)	(0.221)
Age Less Than 5		-0.090	-0.098
		(0.240)	(0.244)
Age 5 to 9		-0.205	-0.226
		(0.198)	(0.199)
Age 10 to 14		-0.208	-0.264*
		(0.153)	(0.160)
Age 15 to 20		-0.307**	-0.311**
		(0.142)	(0.146)
Age 21 to 24		0.210	0.204
		(0.231)	(0.225)
Age 25 plus		-0.189**	-0.204***
		(0.073)	(0.072)
Franchise		-0.209	-0.171
		(0.414)	(0.420)
Fixed Term Percentage		0.006**	0.007**
		(0.003)	(0.003)
Fixed Term		-0.253	-0.287
		(0.187)	(0.196)
Temporary Workers		-0.084	-0.109
		(0.197)	(0.201)
Private		-0.394	-0.453
		(0.518)	(0.508)
Controls for Largest Occupational Group (9)	NO	NO	YES
Cutoff 1	-2.871	-3.523	-3.946
	(0.183)	(0.585)	(0.636)
Cutoff 2	-1.233	-1.783	-2.189
	(0.096)	(0.574)	(0.629)
Cutoff 3	-0.046	-0.521	-0.917
	(0.071)	(0.573)	(0.625)
Cutoff 4	1.150	0.755	0.364
	(0.089)	(0.574)	(0.623)
Sample Size	874	774	774

Note: Standard errors in parentheses. *, **, and *** denote statistical significance at the 10%, 5%, and 1% levels, respectively.

qualitative dependent variable, Financial Performance, indicating the employer's rating of the establishment's financial performance relative to that of other establishments in the same industry, with 1 = "a lot below average", 2 = "below average", 3 = "average", 4 = "above average", 5 = "a lot above average". This paper estimates ordered models using Financial Performance as the dependent variable, Managers and Subordinates as the key independent variables and a set of controls for industry and employer characteristics. Testable prediction 2 implies that the estimated coefficient of Subordinates should be positive and statistically significant; in other words, holding constant the number of managers at the top of the organizational hierarchy, increasing the number of workers lower down in the hierarchy implies higher profit. As revealed in Table 3, in all specifications this result is strongly supported empirically. To interpret the magnitudes implied by the reported ordered probit coefficients, consider an increase of 100 in the number of Subordinates at an establishment. On average, in the most controlled specification (column 3), this change is associated with decreases in the probability that Financial Performance = 1, 2, or 3, an increase of 1.6 percentage points in the probability that Financial Performance = 4, and an increase of 1.1 percentage points in the probability that

Table 6: OLS Models (Dep. Var. = ln [Fraction High Wage / (1- Fraction High Wage)]

	Fractions	Mean	Standard Error
Managers	10.086***	7.169***	6.261***
	(2.527)	(2.282)	(1.972)
Subordinates	-3.005***	-2.208***	-1.952***
	(0.456)	(0.407)	(0.365)
Union		-0.407**	-0.394**
		(0.163)	(0.156)
Fraction of Part Time Workers		-1.002***	-0.891***
		(0.260)	(0.249)
Fraction of Temporary Workers		0.087	0.146
		(0.135)	(0.155)
Percent Union		-0.003	-0.001
		(0.004)	(0.003)
Number of Recognized Unions		0.094	0.118*
		(0.062)	(0.062)
Owner Manager		0.052	0.069
		(0.157)	(0.145)
Foreign Owned		0.172	0.095
		(0.164)	(0.157)
Age Less Than 5		0.110	0.144
		(0.195)	(0.180)
Age 5 to 9		0.307	0.322
		(0.330)	(0.295)
Age 10 to 14		0.258	0.191
		(0.229)	(0.199)
Age 15 to 20		-0.013	0.060
		(0.185)	(0.183)
Age 21 to 24		0.158	0.175
		(0.226)	(0.207)
Age 25 plus		0.082	0.083
		(0.074)	(0.063)
Franchise		-0.819***	-0.676
		(0.307)	(0.255)
Fixed Term Percentage		-0.012***	-0.011**
		(0.003)	(0.004)
Fixed Term		0.129	0.052
		(0.131)	(0.137)
Temporary Workers		-0.190*	-0.165
		(0.108)	(0.111)
Private		-0.245	-0.123
		(0.265)	(0.239)
Controls for Largest Occupational Group (9)	NO	NO	YES
Constant	-1.574***	-1.591***	-0.913***
	(0.062)	(0.348)	(0.348)
Sample Size	1227	1052	1052

Note: Standard errors in parentheses. *, **, and *** denote statistical significance at the 10%, 5%, and 1% levels, respectively

Financial Performance = 5.

Testable prediction 2 pertains to "profit", whereas the preceding empirical test pertains to "financial performance" as interpreted by the respondent employer. In some cases, the employer might interpret financial performance to mean something other than profit. Following the survey question pertaining to financial performance, the WERS asks the employer to state how financial performance is interpreted. The distribution of responses to this clarifying question is displayed in Table 4. Since Testable prediction 2 pertains to "profit", this paper estimated the financial performance ordered models on the subsample for which the employer interpreted "financial performance" to mean "profit", finding again that the coefficient of Subordinates is positive and statistically significant as our theory predicts. Results are displayed in Table 5. To interpret the magnitudes implied by the reported ordered probit coefficients, consider an increase of 100 in the number of Subordinates at an establishment.

Testable prediction 3 states that organizations with more bottom-heavy hierarchical structure have a lower percentage of workers in the upper tail of the within-organization wage distribution. To address this prediction this paper relies on the following WERS measure:

Fraction High Wage

Fraction of workers at the establishment earning Rs. 15.00 per hour or more. Since this variable is a fraction and therefore bounded between 0 and 1, this paper use the natural logarithm of its log-odd ratio as the dependent variable in least squares regression models reported in Table 6. In the most controlled specification, the magnitude of interest that is associated with an increase of 100 in Subordinates is exp (-0.19518) ≈ 0.823, which is the odds of being in the upper tail of the within-establishment wage distribution. This is less than 1 as predicted by this paper model, meaning increases in bottom heaviness are associated with less weight in the upper tail of the within-establishment wage distribution.

CONCLUSION

This paper has proposed a new theory to explain employer decisions to promote managers internally versus recruiting them externally. This is a job assignment model involving fixed-slot job hierarchies, symmetric learning about worker ability, and firm heterogeneity in the returns to managerial talent. This model yields four testable implications: Controlling for the number of managers at the highest level of the job hierarchy, increasing the number of subordinates implies: 1) a greater tendency to promote internally versus recruit from the outside, 2) a greater number of workers in the upper tail of the within-establishment wage distribution, 3) higher profit, 4) more firm-sponsored general training. This paper founds empirical support for all four testable implications in a broad, nationally-representative employer cross section of Indian establishments surveyed in 2017. In addition, it showed that these four testable predictions can also arise from a model based on heterogeneous worker-employer match qualities as opposed to employer heterogeneities in the returns to managerial capability. An interesting direction for extending this work is to enrich the model along the dimension of worker behavior. This model, like most other job-assignment models, does not do this, though (unlike traditional tournament models) it considers a large number of competing employers that determines wage outcomes. This model incorporates some appealing features of tournament models (e.g. fixed-slot job hierarchies) that are usually absent from job assignment models, but even more could be done in future work, potentially yielding an even richer set of testable implications. It is thinks that another interesting direction for future work would be to link the return (or importance) of managerial capability to some characteristics of the employer's product. This paper focus was on firms competing in the same industry, and most controlled empirical specifications held industry constant. Finally, it would be worthwhile addressing new theory with other data sets. While the 2017 WERS has some very attractive features for these purposes, it also has some limitations. The cross sectional nature does not allow controlling for unobserved employer heterogeneity in our models, as would be possible in a panel. Another limitation of the WERS is that it does not contain information on turnover rates by hierarchical level; although it did not focus on turnover in the paper (because our data are not rich enough to address this) model has predictions for how turnover relates to hierarchical shape.

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CONFLICT OF INTEREST

The author declares that there is no conflict of interests regarding the publication of this manuscript. In addition, the ethical issues, including plagiarism, informed consent, misconduct, data fabrication and/or falsification, double publication and/or submission, and redundancy have been completely observed by the authors.

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