The Peter Principle Revisited

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Abstract

Peter and Hull (1969)'s Peter Principle captures two stylized facts about hierarchies: first, promotions often place employees into jobs for which they are less well suited than for that previously held. Second, demotions are extremely rare. Why do organizations not correct "wrong" promotion decision? This paper shows that a simple trade-off between incentive provision and efficient job assignment actually makes it optimal to promote some employees to a job at which they produce less than they would at the previous level. Our model delivers empirical predictions which are consistent with the evidence from the personnel economics literature.

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1 Introduction

According to the *Peter Principle* formulated by Peter and Hull (1969) "in a hierarchy every employee tends to rise to his level of incompetence." This captures two stylized facts about hierarchies: first, promotions often place employees into jobs for which they are less well suited than for the previously held position. Second, demotions are extremely rare (Baker, Gibbs, and Holmstrom 1994a, Baker, Gibbs, and Holmstrom 1994b, Gibbons and Waldman 1999). While the former is not surprising – mistakes can happen – the latter is puzzling; why do organizations not correct "wrong" promotion decisions? Perhaps institutional constraints prevent demotions, but surely an organization that perfectly knew its employees' abilities would make sure that each individual's effort leads to the highest output in his or her current job. While compelling, this intuition is flawed. This paper shows that a simple trade-off between incentive provision and efficient job assignment leads organizations to promote some employees to a job at which they produce less than they would for the same effort in the job held at the previous level.
For this we employ a very simple moral hazard model: a risk neutral and wealth constrained agent can work in one of two jobs (a higher and a lower hierarchy one), where the probability that he succeeds in producing a high output depends in each job on his effort (high or low) and his ability.

In our model, the promotion decision depends on the strength of two effects. On the one hand, promoting the worker reduces the cost of implementing a given effort level if and only if output in the higher level job is more informative about his effort. Empirically, this is the relevant case: jobs further up in the hierarchy of an organization require higher levels of ability, and their output tends to be more informative about the employee's effort (e.g., Maskin, Qian, and Xu (2000), or Ortega (2003)). This is intuitive: if higher hierarchy jobs require a higher ability, seeing a low ability worker succeeding in such a job – which is difficult form him – indicates that he worked really hard. On the other hand, for a given effort level the worker's ability may be such that his success probability is higher in the current job compared to the higher hierarchy one.
Overall, for some ability levels the reduction in the cost of incentives outweighs the negative effect of a reduced success probability, thus creating an upward distortion in job assignment decisions: the promotion threshold for ability is lower than the full information (first best) benchmark. As a consequence, some workers are promoted even though they would produce more in their current job if they exerted the same level of effort (the Peter Principle). Note that this is not a result of the standard effort distortion arising in a moral hazard model, but driven by the differences across the two jobs in informativeness about effort.

Our model delivers empirical predictions which are consistent with the evidence from the personnel economics literature. Along with a rise in the hierarchy an employee often finds that he works more rather than less, and he is not always happier than before. The reason is that promotions to the more informative higher level job allow the principal to keep employees on toes and to extract a high effort from them at lower costs. This delivers an explanation of Peter and Hull's (1969) observation that some individuals are "promoted to their level of incompetence". Our model links to the Peter Principle the empirical pattern that wages at the top of a job exceed those at the bottom of the wage distribution in the next higher level job (Baker, Gibbs, and Holmstrom 1994a, Baker, Gibbs, and Holmstrom 1994b).

This paper is structured as follows. In the next paragraph we discuss the related literature. Section 2 describes the model and Section 3 presents the results. Section 4 concludes.

Related Literature

There is a large literature on careers in organizations and the role of job assignments. One explanation for the use of promotions is learning about the ability of workers. Firms initially place employees in jobs where they can do little harm. Those who prove to be able are then promoted to positions that require a higher level of ability.[1]

A puzzle is why demotions are rare even though many workers are less productive in their job than they would be in a position lower in the hierarchy. Lazear (2004) offers an explanation based on temporary shocks to productivity. A promotion means that a worker has delivered a high measurable output, which is the sum of permanent and transitory components. Because of regression to the mean of the temporary productivity shocks, measured output is expected to decline after a promotion. Our approach is complementary to this. We show that a principal who is perfectly informed about an agent's ability would promote some workers to a higher level task at which they are permanently less productive.

The literature offers two other explanations for the Peter Principle. Fairburn and Malcomson (2001) assume that workers can sway the performance evaluation of their supervisors with direct bribes. This makes incentive pay ineffective for the principal: supervisors and their workers would simply collude to extract high wages without any high effort in return. Making workers' pay contingent on their job, and the managers' pay contingent on the firm's profits, aligns managers' interests more closely with those of the

[1]See Prescott and Visscher (1980) and the survey of the subsequent literature in Gibbons and Waldman (1999).

firm's owners: promoting a very untalented worker reduces profits, and thus hurts the supervisor's pay, more than the the supervisor would gain from extracting a bribe. Still, some workers close to the efficient promotion threshold are promoted even though they should not be. Faria (2000) formalizes an idea from Peter and Hull (1969). He argues that promotion is based on the performance in one task but that the skills required in the new task may be quite different. So, inevitably, some workers turn out to be less competent in the new job than they were in the old one. All these papers, however, do not address why "wrong" promotion decisions are not reversed.

From a theoretical point of view, our model is most closely related to Robbins and Sarath (1998). They show that the principal may not always want to choose the output system that generates the highest revenues. Different output systems vary in how informative they are about the agent's effort, where a more informative system generates lower implementation costs. But such a more informative system need not be the one that also generates higher revenues. Output systems in their paper correspond in our setting to agents with different abilities in the two jobs. Our application allows us to look at a continuum of output systems rather than only two systems as in Robbins and Sarath (1998). This enables us to explain the Peter Principle.

2 The Model

A risk neutral principal can employ a risk neutral agent for two work periods. The agent is protected by limited liability, and has a reservation utility of zero. The principal can assign the agent to one of two jobs, $j \in \{1, 2\}$. In each job the agent produces a verifiable and observable output x, which equals the principal's revenue. Output can either be high ($\bar{x} = 1$) or low ($\underline{x} = 0$). The probability of a high output, $f_j(e, \theta)$, depends on the agent's ability $\theta \in [\theta_L, \theta_H]$, the job $j \in \{1, 2\}$ and effort $e \in \{e_L, e_H\}$, with $f_j : [\theta_L, \theta_H] \times \{e_L, e_H\} \rightarrow (0, 1)$ and $f_j(\cdot, \theta) \in C^2$. We assume that higher effort leads to a higher success probability, i.e. $f_j(e_H, \theta) > f_j(e_L, \theta) \; \forall \, \theta$. The agent's cost of effort is c if he provides high effort and zero otherwise.

We say that job 1 is the *high ability* job and job 2 the *low ability* one. This is captured by the following *sensitivity to ability* (SA) and *single crossing* (SC) assumptions, where subscripts denote partial derivatives with respect to θ:

Assumption 1

(SA) $0 = f_{2\theta}(e_L, \theta) = f_{2\theta}(e_H, \theta) < f_{1\theta}(e_L, \theta) \leq f_{1\theta}(e_H, \theta)$.

(SC) $f_1(e, \theta_L) < f_2(e, \theta_L)$ *and* $f_2(e, \theta_H) < f_1(e, \theta_H)$ *for* $e \in \{e_L, e_H\}$.

Assumption SA consists of two components. First, it says that expected output in job 1 increases with higher ability, and (weakly) more so if higher effort is provided. Thus, effort and ability are weak complements. Second, it says that job 2 entails "safe" tasks, where a low ability agent can do no harm as the success probability is insensitive to ability. Hence, we simplify notation to $f_2(e) \equiv f_2(e, \theta)$, hereafter.

Assumption SC states that for the highest ability level θ_H the success probability in job 1 exceeds the one in job 2, given the same effort level. In contrast, an agent with the lowest ability level θ_L is more productive in job 2 than in job 1, given the same effort level. Together with Assumption SA it implies that for each given pair of equal efforts across jobs, (e, e), there exists a unique type $\hat{\theta}_e$, such that all types with $\theta \geq \hat{\theta}_e$ have a higher success probability in job 1 than in job 2, and all types with $\theta < \hat{\theta}_e$ a lower success probability. This is illustrated in Figure 1. The figure also shows that the probability functions in the two jobs need not cross for unequal efforts. Thus, our single crossing assumption is weaker than the standard one where the two functions cross once for every effort pair.

The Peter Principle refers to cases where the principal chooses a cutoff different from $\hat{\theta}_e$ and the agent produces less in the higher hierarchy job, say, job j (we define the higher hierarchy job below) than if he were reassigned to the former job given he exerts the same effort level as before:

Definition 1 *The Peter Principle holds for an agent with ability θ who is assigned to job j, in which he exerts effort e, if*

$$f_j(e, \theta) < f_i(e, \theta), \quad i \neq j.$$

There is another way to define the Peter Principle: compare expected outputs. This would be misleading, however, as output could simply rise because the agent works much more – hiding the fact that he is untalented for his job. Thus, we compare expected outputs keeping the effort level fixed across jobs.

The timing is as follows. At date 1 the principal offers a contract $[J(\theta), \mathbf{w}]$, consisting of a job assignment rule $J : [\theta_L, \theta_H] \rightarrow \{1, 2\}$, as well as an output contingent wage schemes for each job $\mathbf{w} = [(w_1(\underline{x}), w_1(\bar{x})), (w_2(\underline{x}), w_2(\bar{x}))]$. At this time, the principal and the agent do not know the agent's ability (see below), but it is common knowledge that types are distributed according to the function $\Phi(\theta)$, with $\Phi : [\theta_L, \theta_H] \rightarrow [0, 1]$ and density $\phi(\theta)$, $\phi : [\theta_L, \theta_H] \rightarrow I\!R$. At date 2, after the principal and agent observed θ, the agent is assigned to job $J(\theta)$ and provides unobservable effort. At the last date, output and payoffs realize. The principal receives the revenue and pays the wage to the agent; the agent receives utility equal to the wage minus his effort costs.

Extension of the Model to Capture Promotion Decisions

So far our model captures only job assignments. The framework extends, however, to promotion decisions without affecting the analysis if we add a second work period and modify the timing as follows. At date 1, when the agent is hired, his ability is unknown to all parties and he receives training at date $1\frac{1}{2}$ (the first work period). Training produces an observable and verifiable perfect signal about the agent's ability θ at the end of the period. In the second period, the agent has experience (tenure=1), and everything else is as above.

Let productivity in a job increase with experience (*learning by doing*). That is, we assume that the agent's success probability depends also on his tenure with the principal ($t = \{0, 1\}$): $f_j(e, \theta, t)$, where $f_j(e, \theta, 1) = f_j(e, \theta)$ as described above. A newly hired agent (i.e. with $t = 0$) has a lower success probability: $f_j(e, \theta, 0) = f_j(e_L, \theta)$ for $e \in \{e_L, e_H\}$. That is, the trainee's success probability in task j equals that of an experienced worker who puts in low effort. Hence, it follows that the principal sets wages $W(\underline{x}) = W(\bar{x}) = 0$ for the first work period. We assume that the expected ability of a trainee is such that at date $1\frac{1}{2}$ it is efficient to assign the agent to the low ability job 2.[2]

Assumption 2 $f_2(e_L) > E[f_1(e_L, \theta)]$.

Thus, a worker will in the second work period either stay in the entry level job 2 or be promoted to job 1. This captures the notion that jobs further up in the hierarchy of an organization require higher levels of ability.

3 Analysis

3.1 Observable Effort (First Best)

As a benchmark, suppose first that the principal can observe the agent's effort choice. Thus, to implement high effort in the second work period in task j, she pays $w_j(\underline{x}) = w_j(\bar{x}) = c$ if the agent provides the desired effort and zero otherwise. The resulting profits from assigning an agent of ability θ to job j are $\Pi_j^{FB}(e_H, \theta) = f_j(e_H, \theta) - c$. In contrast, to implement low effort, she sets $w_j(\underline{x}) = w_j(\bar{x}) = 0$ and her profits are $\Pi_j^{FB}(e_L, \theta) = f_j(e_L, \theta)$. For the second best problem to be interesting, we assume that the principal always wants to implement high effort in the first best:

Assumption 3 $\Delta f_j(\theta) \equiv f_j(e_H, \theta) - f_j(e_L, \theta) > c$, $j = 1, 2$.

The first-best promotion threshold to job 1 is efficient: the principal's job assignment rule is $J^{FB}(\theta) = 2$ for all $\theta < \theta^{FB}$ and $J^{FB}(\theta) = 1$ for all $\theta \geq \theta^{FB}$, where $\theta^{FB} = \hat{\theta}_H$.

[2] For example, $E[\theta] < \hat{\theta}_L$ and $f_{1\theta\theta} \leq 0$ would be sufficient for this.

This follows from $\Pi_1^{FB}(e_H, \theta^{FB}) = \Pi_2^{FB}(e_H, \theta^{FB})$ if and only if $f_1(e_H) = f_2(e_H, \theta^{FB})$. Thus, the agent is always assigned to the job where he is more productive and the Peter Principle is not present. The reason is the following: implementation costs are equal to c in both jobs and thus the principal only looks at the expected outputs when deciding to which job she should assign the agent.

3.2 Unobservable Effort (Second Best)

Suppose now that the principal cannot observe the agent's effort. We solve the principal's problem for the second work period with the usual two-step procedure. First, for a given effort level e, we find the cost minimizing wage scheme that implements e. Second, given these wage schemes we maximize profits with respect to effort.

Consider the first part of the problem. If the principal wants to implement low effort in job j she simply sets $w_j(\underline{x}) = w_j(\bar{x}) = 0$, resulting in profits $\Pi_j^{SB}(e_L, \theta) = f_j(e_L, \theta)$. If she wants to implement high effort, her problem is to minimize the expected wage bill,

$$f_j(e_H, \theta)\, w_j(\bar{x}) + [1 - f_j(e_H, \theta)]\ w_j(\underline{x}),$$

subject to the agent's incentive constraint,

$$\Delta f_j(\theta)\ [w_j(\bar{x}) - w_j(\underline{x})] \geq c,$$

where $\Delta f_j(\theta) \equiv f_j(e_H, \theta) - f_j(e_L, \theta)$, limited liability constraint, $w_j(x) \geq 0\, \forall x$ and participation constraint. The latter is always satisfied if the other two constraints are, as the agent's reservation utility is zero. The solution to this problem is to set the wage after failure equal to zero, i.e. $w_j(\underline{x}) = 0$ and choose the wage after a success such that the incentive constraint holds with equality, i.e. $w_j(\bar{x}) = \frac{c}{\Delta f_j(\theta)}$. Hence, the profits from assigning an agent with type θ to job j and implementing high effort are:

$$\Pi_j^{SB}(e_H, \theta) = f_j(e_H, \theta) - C_j(e_H, \theta), \quad C_j(e_H, \theta) = \frac{f_j(e_H, \theta)}{\Delta f_j(\theta)}\, c, \tag{1}$$

where $C_j(e_H, \theta)$ is the expected wage payment for high effort, to which we will refer in the following as the *implementation costs*.

It is optimal to implement high effort in job j if and only if the profits from doing so are higher than the profits from implementing low effort, i.e. if and only if: $\Pi_j^{SB}(e_H, \theta) \geq \Pi_j^{SB}(e_L, \theta)$. Rearranging gives the following condition:

$$[\Delta\, f_j(\theta)]^2 \geq f_j(e_H, \theta)\, c. \qquad \text{(Condition 1)}$$

If this condition is satisfied then profits in job 1 and the difference in profits across jobs increase with the agent's type:

Lemma 1 *Suppose Condition 1 holds, then:*

(a) $\Pi_{1\theta}^{SB}(e_H, \theta) > 0$,

(b) $\frac{d}{d\theta}\left[\Pi_1^{SB}(e_H, \theta) - \Pi_2^{SB}(e, \theta)\right] > 0$ *for* $e \in \{e_L, e_H\}$.

We first analyze job assignments for the case where the principal implements high effort in both jobs, and thereafter consider the remaining cases.

High Effort Optimal in Both Jobs

Suppose that Condition 1 is satisfied for both jobs, i.e. the principal induces the agent to provide high effort in both jobs. To determine the cutoff for the principal's job assignment rule, set $\Pi_1^{SB}\left(e_H, \theta^{SB}\right) = \Pi_2^{SB}\left(e_H, \theta^{SB}\right)$. This leads to the following proposition:

Proposition 1 *Suppose Condition 1 holds for* $j = 1, 2$. *Then, if and only if*

$$f_1\left(e_L, \hat{\theta}_H\right) < f_2(e_L), \qquad \text{(Condition 2)}$$

(a) the promotion threshold to the ability sensitive task 1 is lower than the first-best threshold: $\theta^{SB} < \theta^{FB}$*;*

(b) the Peter Principle is valid for those at the bottom of the ability range in job 1: for $\theta \in [\theta^{SB}, \theta^{FB})$, $J^{SB}(\theta) = 1$ *even though* $f_1(e_H, \theta) < f_2(e_H)$.

Before explaining this proposition in more detail, we state the next result which describes empirical predictions related to the agent.

Proposition 2 *The expected wage payment and expected utility after a promotion are:*

(a) lower than that in job 2 for $\theta^{SB} \leq \theta \leq \theta'$ *and is higher than that in job 2 for* $\theta' > \theta$, *where* $\theta^{SB} < \theta' < \theta_H$ *if and only if*

$$\frac{f_2(e_H)}{f_2(e_L)} > \frac{f_1(e_H, \theta_H)}{f_1(e_L, \theta_H)}; \qquad \text{(Condition 3)}$$

(b) everywhere increasing in θ *if and only if*

$$\frac{f_{1\theta}(e_L, \theta)}{f_1(e_L, \theta)} > \frac{f_{1\theta}(e_H, \theta)}{f_1(e_H, \theta)}. \qquad \text{(Condition 4)}$$

To understand the driving forces behind Proposition 1, consider first the effect of a promotion on the revenues generated by the agent. Given that the principal implements high effort in both jobs, output in job 1 is higher than in job 2 for $\theta \geq \theta^{FB} = \hat{\theta}_H$, as illustrated for a numerical example in Figure 1. But for the principal's profits it also matters what the effect is on the cost of implementing high effort. Hence, the promotion threshold θ^{SB} depends on the combination of both effects. To determine whether θ^{SB} is lower or higher than θ^{FB} we exploit Lemma 1. With Condition 1 the profit difference across jobs is increasing in θ and thus $\theta^{SB} < \theta^{FB}$ if and only if it is more profitable to place an agent with ability level $\theta = \theta^{FB} = \hat{\theta}_H$ in job 1 than in job 2. But note that at this ability level the job allocation does not change the expected revenues because the agent is equally productive in both jobs if he works hard. Therefore, the profit difference is equal to the difference in implementation costs. These costs go down when promoting to job 1 an agent with $\theta = \theta^{FB} = \hat{\theta}_H$ if and only if $f_1\left(e_L, \theta^{FB}\right) < f_2(e_L)$ (Condition 2) holds.

Before we discuss the implications of Propositions 1 and 2 we want to ask about the relevant cases to consider. Empirical evidence suggests that positions further up in the hierarchy tend to be more informative about an employee's effort (Maskin, Qian, and Xu 2000, Ortega 2003). This obtains in our model if Condition 2 and Condition 4 hold. Given that higher hierarchy jobs require a higher level of ability, it is intuitive that these conditions imply that our model matches the empirical observation. The latter condition states that if you are relatively talented you succeed with a high probability even if you put in low effort. In contrast, if you have a low ability you have to compensate for the lack in talent with high effort or risk failure with a high probability. Together with Condition 2 this implies that a relatively low ability agent who wanted to shirk would have a harder time hiding this in job 1 than in the lower level job 2 where he is more productive. Stated differently: if a low ability agent succeeded in a high ability job, he must have worked really hard. Therefore, it takes a higher wage following success to prevent shirking in the lower level job 2, or put differently, implementation costs are lower for the higher hierarchy level job 1.

To see this more formally, note that Condition 2 in conjunction with $f_1\left(e_H, \theta^{FB}\right) = f_2(e_H)$ implies the following relation of likelihood ratios:

$$\frac{f_1\left(e_L, \theta^{FB}\right)}{f_1\left(e_H, \theta^{FB}\right)} < \frac{f_2(e_L)}{f_2(e_H)}. \tag{2}$$

This says that at $\theta = \theta^{FB} = \hat{\theta}_H$ output in the high ability job 1 is *more informative* about the agent's effort in the sense of Demougin and Fluet (1998) than that in the lower ability job 2.[3] Condition 4 then extends Condition 2: it implies that this information relation holds for all $\theta < \theta'$, where $\theta' > \theta^{FB}$ is defined as the ability cutoff at which likelihood ratios are equal.

[3]Note that this definition of informativeness differs slightly from those proposed for the case of risk averse agents with unlimited liability, where an information system i is locally more informative than j if the likelihood ratio distribution of i is a mean preserving spread of that of j (Grossman and Hart 1983, Kim 1995, Jewitt 2006).

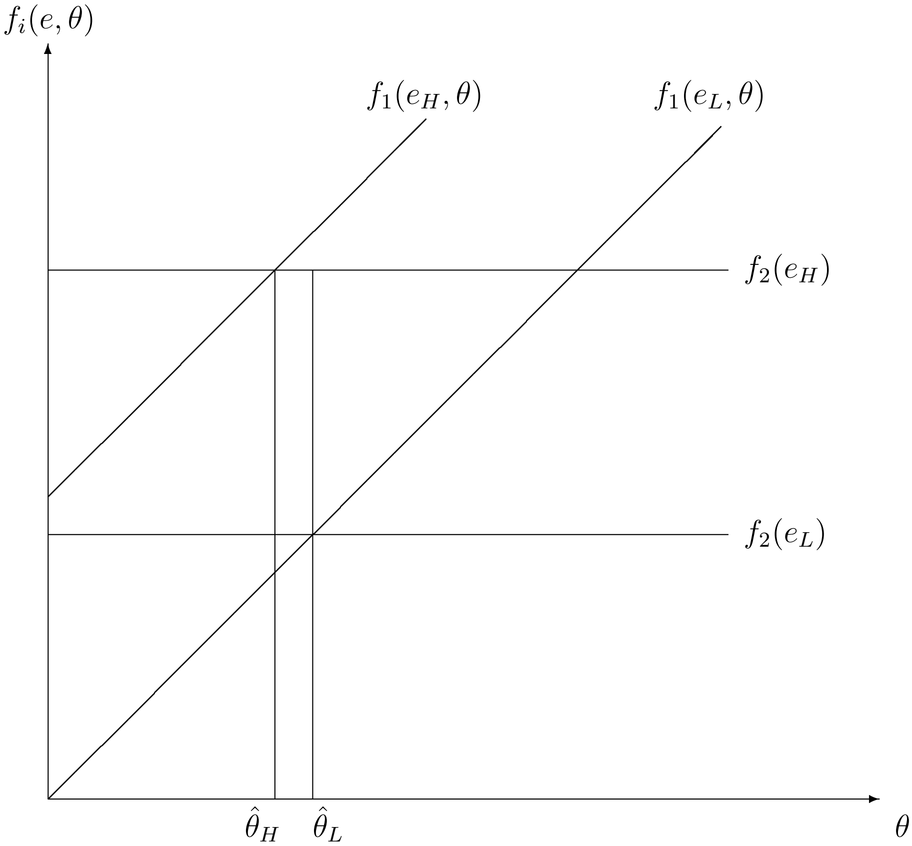

Figure 1: Single Crossing for Success Probabilities with e_L and e_H in both Jobs. $f_1(e,\theta) = g_1(e) + \theta$, with $g_1(e_H) = 0.4$, $g_1(e_L) = 0$ and $f_2(e) = g_2(e)$, with $g_2(e_H) = 0.7$ and $g_2(e_L) = 0.35$.

The existence of such a θ' is guaranteed by Condition 3. It implies that at the top of the ability distribution it is likely that talent matters more for output than effort in higher level positions (e.g. Rosen (1982)). Intuitively, Condition 3 captures the notion of increasing returns to talent in higher level jobs in a hierarchy, stating that at the top talent has such a big impact on the success probability that output in the high ability job 1 is less informative about effort than output in lower level job 2. In other words, if you are extremely talented, you succeed easily even in a demanding high skill job, and this makes it hard for the principal to detect whether your success is due to effort or talent. Thus, she has to compensate you more to make you work hard. Imposing these conditions leads to predictions summarized in Propositions 1 and 2 which are broadly consistent with empirical findings as we argue below.

Proposition 1 shows that it is optimal to promote some individuals "to their level of incompetence" because this reduces the cost of getting them to work hard. The promotion threshold is below the first best level, $\theta^{SB} < \theta^{FB} = \hat{\theta}_H$, and thus the Peter Principle holds for an agent with $\theta^{SB} \leq \theta < \theta^{FB}$: he is promoted to job 1 even though he would produce more in job 2 with the same effort level. Figure 2 illustrates for a numerical example the pattern of expected output predicted by the model. The inefficient promo-

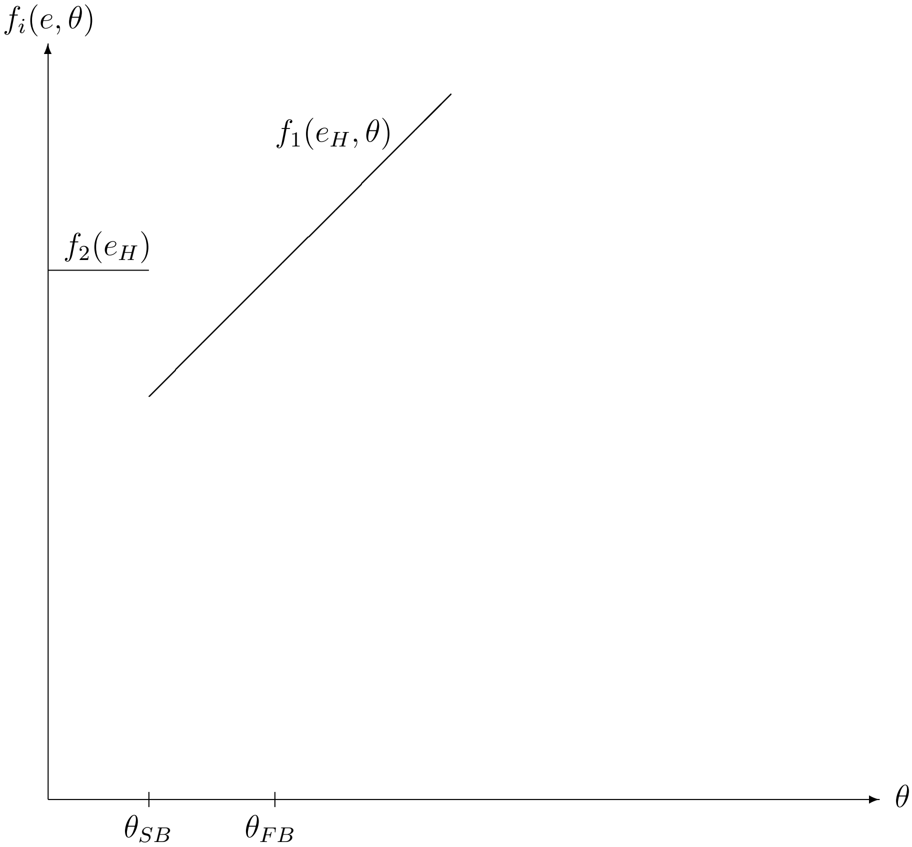

Figure 2: Expected Output for e_H in both Jobs. $f_1(e,\theta) = g_1(e) + \theta$, with $g_1(e_H) = 0.4$, $g_1(e_L) = 0$ and $f_2(e) = g_2(e)$, with $g_2(e_H) = 0.7$ and $g_2(e_L) = 0.35$, $c = 0.25$.

tion threshold – and hence the discontinuity in expected output – is due to differences across the two jobs in informativeness of output about effort, and not caused by the unobservability of effort per se.

Proposition 2 summarizes the implications for the wage policy of the firm. At the top of the ability distribution, success may be driven mostly by talent, and effort may have a lesser impact. This notion is captured by Condition 3. If it holds, we predict the pattern observed in Baker, Gibbs and Holmstrom's (1994b) study: the wages for the bottom tier of the higher level job are lower than those at top tier of the preceding hierarchy level. Thus, our model offers an intuitive explanation that links this "earnings gap" to the Peter Principle. Agents at the bottom tier of the higher level job are less productive than they would be in their old job: their slightly less able colleagues, who remain in the lower level job, simply produce and earn more than they do.

Condition 4 guarantees that expected wages after a promotion increase with the agent's ability. Figure 3 shows that one can easily satisfy these conditions using an additively separable production function $f_1(e,\theta) = g(e) + h(\theta)$, which is often employed in the literature (Fairburn and Malcomson 2001).

The expected utility follows the same pattern as the expected wage: it is given by the expected wages less the cost of effort c. Thus, our model offers an explanation for why

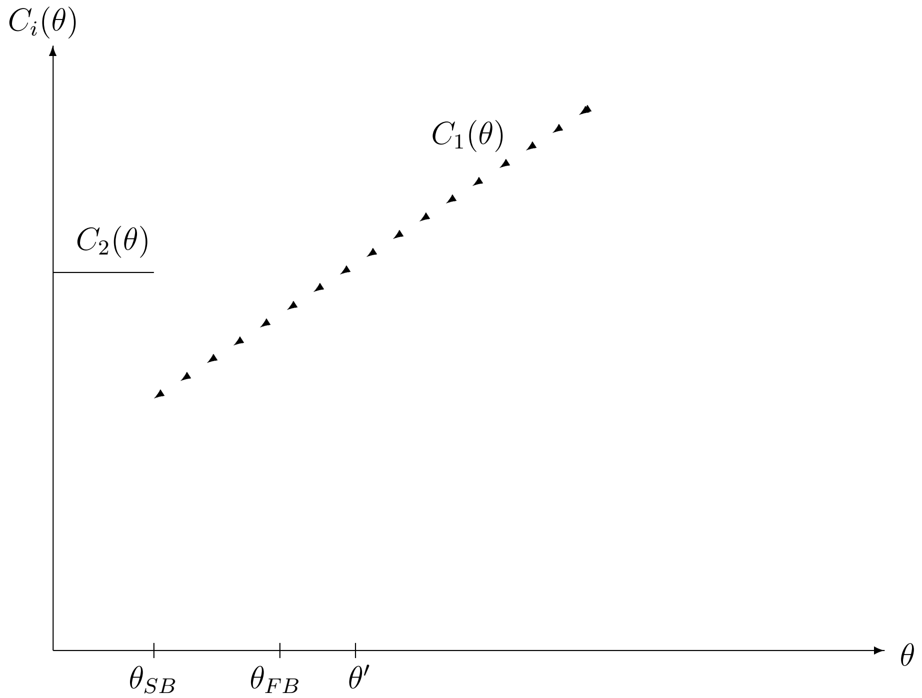

Figure 3: Wage Pattern for e_H in both Jobs. $f_1(e,\theta) = g_1(e) + \theta$, with $g_1(e_H) = 0.4$, $g_1(e_L) = 0$ and $f_2(e) = g_2(e)$, with $g_2(e_H) = 0.7$ and $g_2(e_L) = 0.35$, $c = 0.25$.

individuals often are less happy after a promotion: they are kept on toes by being put into a job for which they are not sufficiently talented.

High Effort not Optimal in Both Jobs

Consider now the case where it is not always optimal for the principal to induce the agent to provide high effort. We consider the empirically relevant setting where output in job 1 is more informative about the agent's effort. Therefore, the moral hazard problem is less severe than that in job 2. For this reason it is more likely that the principal implements high effort in job 1 than in job 2. Put differently, when moving up the career ladder the agent is going to work more rather than less and is rewarded more often with a performance related incentive scheme. This is what one typically observes in firms: lower hierarchy workers simply receive a wage, while a manager's compensation often includes performance related elements such as bonuses or stocks. In our model, an implication of this is that the promotion threshold is less distorted than in the case where agents are made to provide high effort in both jobs. The reason is that the principal is less tempted to assign an agent to the higher level job because the agent always earns more than in the lower level job. But, as we will see later, the Peter Principle can still hold. Before discussing this further, we summarize our results on implemented effort levels and the promotion threshold in the following lemma:

Lemma 2

(a) The implemented effort in job 1 is higher than in job 2, i.e. $e_1^{SB}(\theta) \geq e_2^{SB}$, $\forall\,\theta$;

(b) The promotion threshold to the ability sensitive task 1, θ^{SB}, *is higher than when* $e_1^{SB}(\theta) = e_2^{SB} = e_H\ \forall\,\theta$.

In contrast to the case where high effort was always optimal, the optimal effort level can now stay at e_L or increase from e_L to e_H after a promotion. The possible scenarios are summarized in the following result – showing when the Peter Principle emerges and when not:

Proposition 3 *Suppose that Condition 1 fails to hold for job 2 (i.e.* $e_2^{SB} = e_L$*).*

(a) $\theta^{SB} < \theta^{FB}$ *and the Peter Principle holds for* $\theta \in [\theta^{SB}, \theta^{FB})$ *if and only if Condition 1 is satisfied for job 1 (i.e.* $e_1^{SB}(\theta) = e_H$*) and* $C_1\left(e_H, \theta^{FB}\right) > f_1\left(e_H, \theta^{FB}\right) - f_2(e_L)$.

(b) $\theta^{FB} < \theta^{SB} = \hat{\theta}_L$ *and the Peter Principle holds for any ability level if and only if Condition 1 is satisfied for job 1 (i.e.* $e_1^{SB}(\theta) = e_L$*).*

In Part (b), no incentives are required in any job and the promotion threshold depends solely on the impact of the job assignment on output. That is, the promotion threshold is $\hat{\theta}_L$ and the agent is assigned to the job in which he is most productive.

Part (a) shows that at the first-best promotion threshold θ^{FB} assigning the agent to the higher level job leads to an increase in output given by $f_1\left(e_H, \theta^{FB}\right) - f_2(e_L)$. If and only if this is sufficient to compensate for the cost of implementing high effort, $C_1\left(e_H, \theta^{FB}\right)$, we have that $\theta^{SB} < \theta^{FB}$ and the Peter Principle holds. It is interesting to note that an inefficiently low promotion threshold can arise even in the case where the agent always earns strictly more when he moves up the career ladder. But even though the wage is higher, the principal can gain from promoting the agent: as the output of a low ability agent is more informative in a high ability job, the principal can induce him to work hard in job 1 when she would only like to implement low effort in job 2.

If, however, the agent is so untalented that even the lower implementation costs for high effort in job 1 cannot outweigh his lack in talent, then $\theta^{SB} \geq \theta^{FB}$ and the Peter Principle does not hold: even though too few workers are promoted relative to the first best scenario, a worker is never more productive in the other job holding effort constant. The reason is that in both jobs this low talented agent would be made to exert low effort. Thus, the distortion in the promotion threshold cannot be driven by the desire to exploit lower effort implementation costs in job 1.

For both of these cases in Proposition 3, the expected wage and expected utility of the agent increases after a promotion. Thus, our model predicts an immediate wage rise for those cases where the agent has to work harder after a promotion than in the previously held lower hierarchy level job.

4 Conclusion

This model provides a simple explanation for why organizations only rarely correct what appears to be at first glance a botched promotion. Jobs higher up in the hierarchy of an organization tend to be more informative about the effort of an employee. For this reason, an organization may find it optimal to promote an employee even if this leads to a reduction in output (the Peter Principle). This decrease in expected output can be outweighed by the reduction in implementation costs caused by the higher level job being more informative about effort.

Appendix

Proof Lemma 1.

$$\begin{aligned}
\Pi_{1\theta}^{SB}(e_H,\theta) &= f_{1\theta}(e_H,\theta) - C_{1\theta}(\theta) \\
&= f_{1\theta}(e_H,\theta) - \frac{f_1(e_H,\theta)\, f_{1\theta}(e_L,\theta) - f_1(e_L,\theta)\, f_{1\theta}(e_H,\theta)}{[\Delta f_1(\theta)]^2}\, c \\
&> f_{1\theta}(e_H,\theta) - \frac{f_1(e_H,\theta)\, f_{1\theta}(e_L,\theta)}{[\Delta f_1(\theta)]^2}\, c > 0,
\end{aligned}$$

as $f_{1\theta}(e_H,\theta) \geq f_{1\theta}(e_L,\theta)$ (Assumption 1 SA) and $[\Delta f_1(\theta)]^2 > f_1(e_H,\theta)\, c$ (Condition 1). This shows Part (a). Part (b) follows immediately. ∎

Proof Proposition 1.

$$\begin{aligned}
\Pi_1^{SB}(e_H,\theta^{FB}) - \Pi_2^{SB}(e_H) &> 0 \\
\Leftrightarrow \quad f_1(e_H,\theta^{FB}) - C_1(e_H,\theta^{FB}) &> f_2(e_H) - C_2(e_H) \\
\Leftrightarrow \quad C_1(e_H,\theta^{FB}) &< C_2(e_H) \\
\Leftrightarrow \quad f_1(e_H,\theta^{FB}) - f_1(e_L,\theta^{FB}) &> f_2(e_H) - f_2(e_L) \\
\Leftrightarrow \quad f_1(e_L,\theta^{FB}) &< f_2(e_L),
\end{aligned}$$

using repeatedly $f_1(e_H,\theta^{FB}) = f_2(e_H)$. The resulting inequality $f_2(e_L) > f_1(e_L,\theta^{FB})$ implies that $\hat{\theta}_H < \hat{\theta}_L$. The rest of Part (a) follows because the profit difference is strictly increasing in θ (Lemma 1). Part (b) follows directly from $\theta^{SB} < \theta^{FB}$ and because high effort is implemented in both jobs. ∎

Proof Proposition 2.

For Part (a) note that the difference between the expected wage payment in job 1 and job 2 for an agent with type θ is:

$$\frac{f_1(e_H,\theta)}{f_1(e_H,\theta) - f_1(e_L,\theta)}\, c - \frac{f_2(e_H)}{f_2(e_H) - f_2(e_L)}\, c = \frac{f_1(e_L,\theta)\, f_2(e_H) - f_1(e_H,\theta)\, f_2(e_L)}{[f_1(e_H,\theta) - f_1(e_L,\theta)]\,[f_2(e_H) - f_2(e_L)]}\, c.$$

This is negative at θ^{SB} because $\theta^{SB} < \hat{\theta}_L$:

$$f_1\left(e_L,\theta^{SB}\right) f_2(e_H) - f_1\left(e_H,\theta^{SB}\right) f_2(e_L) = f_2(e_H)\left[f_1\left(e_L,\theta^{SB}\right) - f_2(e_L)\right] < 0,$$

and positive at θ^{FB} if and only if:

$$f_1(e_L,\theta_H)\, f_2(e_H) - f_1(e_H,\theta_H)\, f_2(e_L) > 0 \Leftrightarrow \frac{f_2(e_H)}{f_2(e_L)} > \frac{f_1(e_H,\theta_H)}{f_1(e_L,\theta_H)},$$

which gives us – using the intermediate value theorem – the condition in the text.

For Part (b) note that $C_{1\theta}(\theta) = \frac{f_1(e_H,\theta)\, f_{1\theta}(e_L,\theta) - f_1(e_L,\theta)\, f_{1\theta}(e_H,\theta)}{[\Delta f_1(\theta)]^2}\, c$ is positive if and only if the numerator is positive which gives Condition 4 when rearranged.

Part (c) follows directly because the expected utility is the expected wage minus cost of effort

c. ■

Proof Lemma 2 and Proposition 3.

Consider the second best profits in jobs 1 and 2. Suppose that *high* effort is implemented in both. From the Proof of Proposition 1 we know that the threshold where both these profits (which need not be the optimal second best levels - low effort implementation can be optimal) are equal is less than $\theta^{FB} = \hat{\theta}_H < \hat{\theta}_L$. Denote the threshold that makes them equal by $\tilde{\theta}$. Thus, $f_1\left(e_L, \tilde{\theta}\right) < f_2(e_L)$ so:

$$\begin{aligned} & \Pi_1^{SB}\left(e_H, \tilde{\theta}\right) - \Pi_1^{SB}\left(e_L, \tilde{\theta}\right) = \Pi_2^{SB}(e_H) - f_1\left(e_L, \tilde{\theta}\right) \\ > \ & \Pi_2^{SB}(e_H) - f_2(e_L) = \Pi_2^{SB}(e_H) - \Pi_2^{SB}(e_L). \end{aligned}$$

The second best promotion threshold is strictly higher than $\tilde{\theta}$. Suppose first that Condition 1 holds for job 1. Then $\Pi_2^{SB}(e_L) = f_2(e_L) > f_1\left(e_L, \tilde{\theta}\right) - C_1\left(e_L, \tilde{\theta}\right) = \Pi_1^{SB}\left(e_H, \tilde{\theta}\right) = \Pi_2^{SB}(e_H)$. As $\Pi_1^{SB}(e_H, \theta)$ is increasing in θ, we have that $\theta^{SB} > \tilde{\theta}$. Suppose now that Condition 1 does not hold for job 1. Then it follows immediately that $\theta^{SB} = \hat{\theta}_L > \tilde{\theta}$. ■

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