# The Peter Principle: A Theory of Decline

for

A Special Issue of the *Journal of Political Economy*
in Memory of Sherwin Rosen

Edward P. Lazear

Hoover Institution
and
Graduate School of Business

Stanford University

November, 2001

Sherwin Rosen was my most important teacher, my valued colleague and dear friend. Sherwin served on my thesis committee and taught me much of what I know. Throughout the thirty years that we were friends, Sherwin was a constant source of inspiration, wisdom, and kindness. A deep thinker who opened up a number of areas or research, Sherwin was interested in hierarchies and promotion, so this paper is very much in keeping with his research agenda and derives from it.

Abstract

Many have observed that individuals perform worse after having received a promotion. The most famous statement of the idea is the Peter Principle, which states that people are promoted to their level of incompetence. There are a number of possible explanations. Two are explored. The most traditional is that the prospect of promotion provides incentives, which vanish after the promotion has been granted; thus, tenured faculty slack off. Another is that output falls purely as a statistical matter. Being promoted is evidence that a standard has been met. Regression to the mean implies that future productivity will decline on average. Firms optimally account for the regression bias in making promotion decisions, but the effect is never eliminated. Usually, firms inflate the promotion criterion to offset the Peter Principle effect, and the greater the amount of the inflation of the standard, the larger the dispersion of the pre-promotion error. The same logic applies in other applications. For example, the logic explains movie sequels being worse than the original film on which they are based and popular restaurants going out of fashion.

"He wrote such good papers until we gave him tenure."

The quote above reflects a view often held by faculty members about their colleagues. Individuals who are striving for tenure often produce very good work, only to follow it by output far below the pre-tenure level after tenure is awarded. One possibility is that individuals game the system. Knowing that their senior colleagues are going to judge them on the basis of their pre-tenure work, junior academicians put forth extraordinary effort in order to convince their seniors that long-term research prospects are favorable. After tenure is awarded, the value of effort declines and with it the amount of effort supplied.

Another possibility is that there is no strategic behavior at all. Instead, the decline in productivity may be the natural outcome of a statistical process that displays regression to the mean. Workers are promoted on the basis of having met some standard. To the extent that output is the sum of both permanent and transitory components, those who meet the standard will have expected transitory components that are positive. The expectation of the post-promotion transitory component is zero, implying a reduction in expected output. Firms that understand the statistical process take this phenomenon into account by adjusting the promotion standard, but the result remains: Expected output is lower after promotion than before.[1]

[1]It is also true that those who are denied promotion do better after they are turned down than they did before the decision was made, for the same reason.

Furthermore, the individuals who behave strategically do not necessarily put forth more effort than is efficient. In fact, the reverse may be true. The nature of the action depends specifically on the compensation formula offered to the post-promotion workers. If workers are paid on the basis of their output after promotion, then somewhat surprisingly, some workers will strategically underwork before tenure. If, on the other hand, easy jobs receive post-promotion wages that are independent of their post-promotion output, then pre-promotion overproduction is the rule.

The Peter Principle, which states that workers are promoted to their level of incompetence, is one version of this phenomenon. After workers are promoted, they do worse than they did before promotion.[2] There is substantial evidence of the phenomenon. In addition to papers from the marketing and organizational behavior literature,[3] there are a number of findings in empirical labor economics that support the claim. In an early paper that used subjective performance evaluation, Abraham and Medoff (1980) reported that workers' subjective evaluation scores fell, the longer they were on the job. In Lazear (1992), it was found that the coefficient of job tenure in a wage regression was actually negative. The longer a worker was in a particular job, given his tenure in the firm, the lower his wage. The reason presumably is that the better workers are promoted out of

[2]Two recent papers [Fairburn and Malcolmson (2000) and Faria (2000)] on this topic use a very different approach from this paper and from each other. The Peter Principle is a by-product of using promotion to solve a moral hazard problem in Fairburn and Malcolmson. Rather than motivate through money, which induces influence activity, firms choose promotion because then managers must live with the consequences of their decisions. Too many workers are promoted under certain circumstances, resulting in a Peter Principle effect. In Faria (2000), workers have two skills. Those who are good at one are necessarily less good at another when on the frontier. Faria argues that this is what is meant by the Peter Principle.

[3]See, for example, Anderson, Dubinsky, and Mehta (1999).

the job so those with a given number of years of firm experience who have fewer years in a job are less likely to have gotten stuck in that job. Baker, Gibbs and Holmstrom (1994) replicate this finding in their data and Gibbs and Hendricks (2001) find that raises and bonuses fall with tenure.

The tone of the literature outside of economics is that there is something wrong with promotion dynamics, and this anomaly shows up as the Peter Principle. (Indeed, the book written by Peter and Hull is entitled, *The Peter Principle: Why Things Always Go Wrong.*) The view is that political or other factors must induce a promotion rule that is somehow inappropriate. The approach taken here is different. The Peter Principle results from optimal adjustment to decision- making under uncertainty.

More often, the Peter Principle is interpreted in a multi-factor context. Individuals who are good in one job are not necessarily good in the job into which they are promoted. As a result, individuals appear incompetent in the job in which they settle. No further promotions result. To obtain this result, it is merely necessary to make a slight modification in the regression-to-the-mean structure. Here, general ability is combined with a job-specific ability to produce output. Regression to the mean results because positive readings on the job-specific component prior to promotion is uncorrelated with the job-specific component after promotion.[4]

The fact that promoted individuals are less able than their apparent pre-promotion ability induces firms to adjust in two respects. First, firms select their promotion rule with the understanding that the pre-promotion ability is a biased estimate of true ability for those who exceed

[4]The structure is a variant of the Jovanovic (1979a,b) model that was modified and used in a context closer to this structure in Lazear, (1986).

some standard. Second, as the variance in the transitory component of ability rises relative to the variance in the permanent component, the length of time over which a promotion decision is made increases. Noisier information results in longer optimal probationary periods.

The model presented below yields the following results:

1. Promoted individuals' performance falls, on average, relative to their pre-promotion performance.
2. Firms that take the decline into account adjust their promotion rule accordingly, but this does not negate the observation that ability declines after promotion.
3. The importance of the Peter Principle depends on the amount of variation in the transitory component relative to the permanent. The Peter Principle is most pronounced when the transitory component is large.
4. The length of the pre-promotion period depends on the ratio of transitory variation to permanent variation. As the transitory component becomes more important, firms lengthen the pre-promotion period.
5. Movie sequels are systematically worse than the original on which they are based.
6. Great restaurants go out of fashion as follow-up visits provide poorer meals than the first sampling.

## A. Model

Let there be two periods. Each worker has a time-invariant component of ability, denoted $A \sim f(A)$, and a time-varying component of ability, denoted $\varepsilon_1$ for period 1 and $\varepsilon_2$ for period 2. Let the time-varying components be i.i.d. with density $g(\varepsilon)$. The firm can observe $A+\varepsilon_t$ in each period,

but cannot disentangle the time-varying component of ability from the permanent component. There are a variety of interpretations that are consistent with this specification. One can think of the $\varepsilon_t$ as being a true transitory component or just measurement error. Later, the interpretation of different jobs will be considered.

There are two jobs (two are sufficient), which we denote difficult and easy. An individual's productivity in the easy job is given by

$$\alpha + \beta(A+\varepsilon_t)$$

and in the difficult job is given by

$$\gamma + \delta(A+\varepsilon_t)$$

where $\alpha>\gamma$ and $\delta>\beta$. Thus, it pays to assign a worker to the difficult job if and only if

$$A+\varepsilon_t > x$$

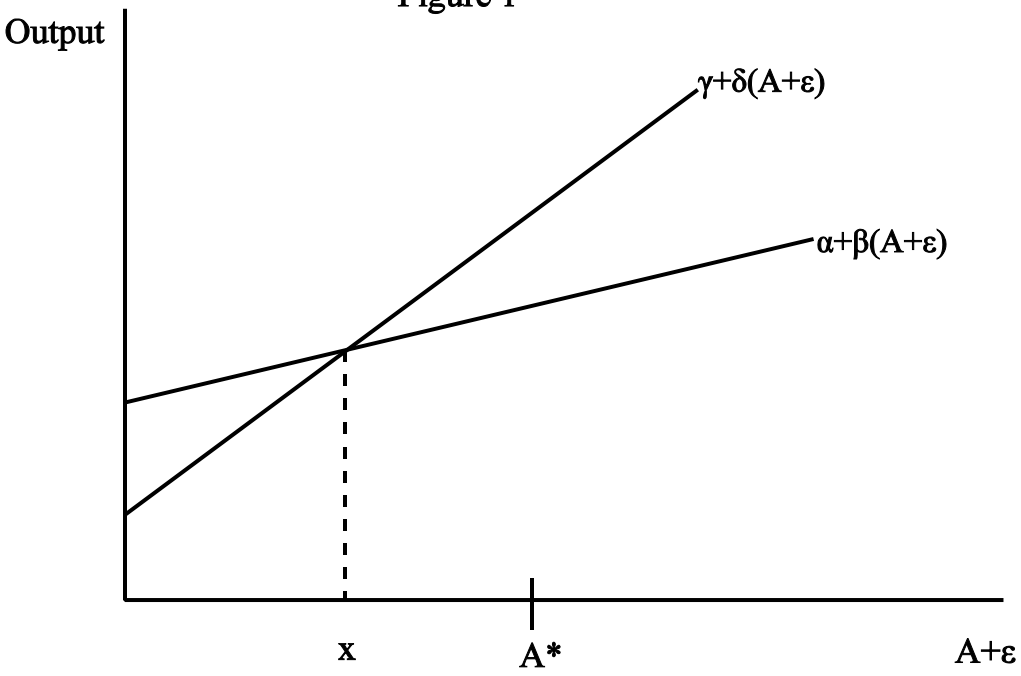
where

$$x \;/\; (\alpha-\gamma) / (\delta-\beta)$$

The situation and the crossing point that correspond to x are shown in figure 1.[5] The setup seeks to capture the idea that the most able have a comparative advantage in the difficult job.

[5]This production structure is similar to that used in a comprehensive analysis by Gibbons and Waldman (1999), who also allow for transitory and permanent components with regression. The focus of their paper is earnings and promotion. Neither optimal decision-making by firms given the transitory component, nor strategic effort in response to promotion rules are central to their discussion.

Figure 1




Assume that individual ability f(A) is such that in the absence of information, it pays to assign everyone in period 1 to the easy job.[6] Intuitively, this assumption amounts to saying that most people are not well-suited to the difficult and that in the absence of countervailing information, individuals are assigned to the easy job.

After the first period, firms obtain an estimate of A, namely $\hat{A} = A + \varepsilon_1$. Since $\varepsilon_1$ is the period one transitory component (either measurement error or transitory ability), it is A and not

[6]This amounts to assuming that $\int_{-\infty}^{\infty}\int_{-\infty}^{\infty}(\alpha + \beta(A+\varepsilon))dGdF > \int_{-\infty}^{\infty}\int_{-\infty}^{\infty}(\gamma + \delta(A+\varepsilon))dGdF$ .

$\hat{A}$ on which a promotion decision should be made. But A is not observed, so firms are forced to base their decision on $\hat{A}$.

**1. Workers perform worse after being promoted**

Firms must select some criterion level, A*, such that if $\hat{A}$ > A* the worker is promoted to the difficult job. If $\hat{A}$ is less than A*, the worker remains in his current job. It is now shown that workers who are promoted have levels of ability in period 1 that are higher on average than their ability in period 2.

First, note that the expectation of $\varepsilon_1$ given that an individual is promoted, is

$$E(\varepsilon_1 | A + \varepsilon_1 > A^*) = \int_{-\infty}^{\infty} \int_{A^* - A}^{\infty} \frac{1}{1 - G(A^* - A)} \varepsilon \, g(\varepsilon) f(A) d\varepsilon \, dA$$

$$= \int_{-\infty}^{\infty} E(\varepsilon \mid \varepsilon > A^* - A) f(A) dA$$

which is positive since f(A) is positive and the conditional expectation of ε given ε greater than any number is positive (because the unconditional expectation of ε is zero).

Thus, the conditional expectation of $\varepsilon_1$ is positive among those who are promoted.

Now, in period 2, the expectation of the transitory component is

$$E(\varepsilon_2 \mid A + \varepsilon_1 > A^*) = 0$$

because $\varepsilon_2$ is independent of A and of $\varepsilon_1$ . As a result, for any promoted individual with ability A,

$$A + E(\varepsilon_1 \mid A + \varepsilon_1 > A^*) > A + E(\varepsilon_2 \mid A + \varepsilon_1 > A^*) .$$

Thus, expected ability falls for promoted individuals from period 1 to period 2.

Individuals who are promoted are promoted in part because they are likely to have high permanent ability,[7] but also because the transitory component of their ability is high. One of the reasons that academics tend to write better papers before they receive tenure is that they would not have received tenure had they not written the better-than-average papers. The point is obvious, but is made graphic by the following example. Suppose that a firm promotes all individuals who can obtain three heads on three consecutive coin tosses. Only one in eight will be promoted. But when the firm asks their promoted individuals to repeat the feat, only one in eight will measure up. Seven out of eight will do worse than they did before being promoted. The reason is that all of the "performance" on the coin toss is transitory since tosses are independent.

As a general matter, the larger is the transitory component relative to the permanent component, the more important is the Peter Principle effect. If there were no transitory component, there would be no regression to the mean. Thus, the importance of "luck" is positively associated with the force of the Peter Principle.

---

[7]The notation $\varepsilon_1$ and A could be swapped in the above discussion to show that $E(A|A+\varepsilon_1>A^*) > E(A)$ .

## 2. The Promotion Rule

Firms know in advance that there will be some expected fall in productivity among those promoted and adjust their promotion standard accordingly. Below, the general optimization problem for the firm is presented. Then, the way in which the rule operates is demonstrated by an example.

The firm's problem is to maximize profits (or worker utility) by selecting the job for each candidate with the highest expected value. Recall that individuals who have period 2 ability greater than x, defined above, would be assigned to job 2 were second period ability known. The firm does not see A, but only $\hat{A}$ and must choose some criterion, A*, such that it promotes workers whose observed ability in period 1 is greater than A*. This is equivalent to promoting individuals when $A > A^* - \varepsilon_1$. Thus, the firm wants to choose A* so as to maximize

$$(1)\quad \underset{A^*}{Max} \int_{-\infty}^{\infty}\int_{A^*-\varepsilon_1}^{\infty}\int_{-\infty}^{\infty}(\gamma + \delta(A+\varepsilon_2))f(A)g(\varepsilon_1)g(\varepsilon_2)\,d\varepsilon_2\,dA\,d\varepsilon_1$$

$$+ \int_{-\infty}^{\infty}\int_{-\infty}^{A^*-\varepsilon_1}\int_{-\infty}^{\infty}(\alpha + \beta(A+\varepsilon_2))f(A)g(\varepsilon_1)g(\varepsilon_2)\,d\varepsilon_2\,dA\,d\varepsilon_1$$

Because the expectation of $\varepsilon_2$ is zero, (1) can be written as

$$(2)\quad \underset{A^*}{Max} \int_{-\infty}^{\infty}\int_{A^*-\varepsilon_1}^{\infty}(\gamma + \delta A)dFdG + \int_{-\infty}^{\infty}\int_{-\infty_1}^{A^*-\varepsilon_1}(\alpha + \beta A)dFdG$$

The choice of A* depends on the distribution. However, two examples reveal that A* does not equal x as a general rule. Instead, in typical cases, firms adjust A* upward. Knowing that worker ability in period 2 will differ from worker ability in period 1, firms usually set the bar higher than they would were ability observed in period 1 carried over directly to period 2.

Actual solutions that provide intuition are available for given distributions. Consider, for example, the case where A, $\varepsilon_1$, and $\varepsilon_2$ are all distributed normally, with mean zero and variance equal to 1. Let $\alpha=1$, $\beta=.5$, $\gamma=0$, $\delta=1$. Then x, the ability level at which jobs produce equal value, is 2 since

$$\alpha + \beta(A+\varepsilon) = \gamma + \delta(A+\varepsilon)$$

for $A+\varepsilon = 2$. However, A* is 4.01. The firm sets its promotion standard more than two standard deviations higher than the crossing point in figure 1 because it understands that the worker's ability in period 2 is likely to be lower than it was in period 1 for the promoted group. As a result, the firm insists on a very high level of observed ability in period 1 in order to warrant promotion. Statements like, "tenure requires that the faculty member be the best in his field, having produced outstanding research'" is a manifestation of the upward adjustment.

Consider the same example with a twist. Let the distribution of A remain the same, namely, normal with mean 0 and standard deviation of 1, but let the standard deviation of $\varepsilon_1$ fall to 0.1. Then, A* drops from 4.01 to 2.08. Although the firm still adjusts its promotion criterion upward from x, the adjustment is much smaller because the importance of the transitory component has been diminished. There is regression to the mean, but the regression that takes place is small relative to the amount in the prior example. When the standard deviation of $\varepsilon$ is zero, the promotion standard is 2, which is exactly x as expected. Then, the distribution of $\varepsilon_1$ is degenerate, so that all observed

ability in period 1 is permanent ability. The problem in (2) becomes

$$\underset{A^*}{Max} \int_{A^*}^{\infty} (\gamma + \delta A) f(A) dA + \int_{-\infty}^{A^*} (\alpha + \beta A) f(A) dA$$

which has first order condition

$$\frac{\partial}{\partial A^*} = -(\gamma + \delta A^*) f(A^*) + (\alpha + \beta A^*) f(A^*) = 0 \quad .$$

The solution is

$$(\gamma + \delta A^*) = (\alpha + \beta A^*)$$

which is the crossing point, i.e., x, in figure 1. When there is no transitory component, the firm simply promotes those whose permanent ability places them better in the difficult job than in the easy job.

It is possible to derive the relation between A* and x in more general terms.[8] The first-order condition to (2) is

$$(\gamma + \delta A^* - \alpha - \beta A^*) \int_{-\infty}^{\infty} f(A^* - \varepsilon_1) g(\varepsilon_1) d\varepsilon_1 = (\delta - \beta) \int_{-\infty}^{\infty} \varepsilon_1 f(A^* - \varepsilon_1) g(\varepsilon_1) d\varepsilon_1$$

[8]I am gratefully indebted to Wing Suen for this derivation.

The integral on the l.h.s. is always positive, so the whether A* exceeds x or not depends on the sign of the integral on the r.h.s. Assume that both f() and g() are symmetric densities and let g( ) be symmetric around zero and f() be symmetric around $\overline{A}$. Write the integral on the right side as

$$\int_{-\infty}^{0} \varepsilon_1 f(A^* - \varepsilon_1) g(\varepsilon_1) d\varepsilon_1 + \int_{0}^{\infty} \varepsilon_1 f(A^* - \varepsilon_1) g(\varepsilon_1) d\varepsilon_1$$

Use a change of variable in the first integral of $u=-\varepsilon_1$ and in the second, allow $u=\varepsilon_1$. Because of symmetry, g(u) = g(-u) so one can write the two integrals as one:

$$\int_{0}^{\infty} u[f(A^* - u) - f(A^* + u)] g(u) du$$

Suppose that the firm wants to promote fewer than 50% of the people, i.e., that $x > \overline{A}$. (Recall that x is the value such that $\alpha + \beta x = \gamma + \delta x$. If $x = \overline{A}$, then because of symmetry of the density functions, half of the population would have A>x and half would have A< x.) Under such circumstances, f(x-u) > f(x+u) (because f is unimodal around $\overline{A}$). Thus, the r.h.s. of the first-order condition is positive for A*=x, which implies that

$$\alpha + \beta A^* > \gamma + \delta A^*$$

or that A* > x. Thus, the firm adjusts the cutoff level upward when fewer than 50% of the workers are better suited to the difficult job than the easy job.

The same reasoning applies in reverse. If more than 50% are to be promoted, then $x < \overline{A}$

which means that $f(x-u)<f(x+u)$. As a result, the r.h.s. of the first-order condition is negative at x, which means that A* must be less than x to satisfy optimality. Thus, when more than 50% better suited to the difficult job than the easy job, the firm reduces the promotion cutoff below that which would be optimal were their no error in period one. (Actually, under such circumstances, workers would initially be assigned to the difficult job and the standard would be one such that workers who fell below it would be demoted after the first period.)

The intuition is this. Although there is always regression to the mean, adjusting the promotion level upward reduces the probability that the firm will make a bad promotion decision. However, at the same time, the adjustment increases the probability that it will fail to promote a qualified worker i.e., it reduces the false positive while increasing the false negative error. Conversely, lowering the promotion cutoff reduces the probability that someone who erroneously was observed to be a poor worker is not promoted, but increases the probability that the firm promotes too many bad workers. Thus, there is a tradeoff. When fewer than 50% are to be promoted, the expected cost of making a false positive error exceeds that of making a false negative error so that the criterion must be adjusted upward. To the extent that most hierarchies are narrower at the top than at the bottom, $A^*>x$ is probably the more typical case, So $A^*>x$. Standards are adjusted upward.

### B. Strategic Behavior by Workers

So far, worker effort has been assumed to be given. In this section, we relax the assumption that effort is given in order to determine how workers may game the system to alter their promotion possibilities. As will be shown, workers will over-produce during the pre-promotion period. The

nature of strategic behavior depends on the compensation scheme.

In order to examine incentives, it is necessary to define three more terms: $\mu_1$ which is effort in period 1, $\mu_2$ which is effort in period 2 if the worker is not promoted, and $\mu_2$*, which is effort in period 2 if the worker is promoted. Note that effort in period 1 is determined before the promotion decision is made, so period 1 effort is independent of promotion. Of course, it is possible that effort in period 1 will be contingent on a worker's ability, since ability affects the probability of promotion. Now, let the cost of effort be given by $C(\mu)$. For simplicity, $C(\mu)$ is assumed to be independent of ability and the same across periods.

**1. Piece Rates**

The compensation scheme matters greatly, so begin by supposing that a worker is paid a piece rate. Then, in period 2, a worker who has not been promoted chooses effort, $\mu_2$, so as to solve

$$\underset{\mu_2}{Max} \quad \alpha + \beta E(A+\mu_2+\varepsilon_2) - C(\mu_2)$$

or

$$(3) \qquad \underset{\mu_2}{Max} \quad \alpha + \beta(A+\mu_2) - C(\mu_2).$$

The first order condition to (3) is

$$(4) \qquad C'(\mu_2) = \beta \quad .$$

An analogous problem can be solved for those who are promoted. Their problem is

$$(5) \qquad \underset{\mu_2^*}{Max} \quad \gamma + \delta(A_2+\mu_2^*) - C(\mu_2^*)$$

which has first-order condition

$$(6) \qquad C\mathbb{N}(\mu_2^*) = \delta \ .$$

Eqq. (4) and (6) define $\mu_2$ and $\mu_2^*$. Promoted workers put forth more effort in period 2 because the marginal return to effort is higher in the difficult job than in the easy job, i.e., $\delta>\beta$. Given this, the worker solves a two-period problem in period 1, knowing that he will choose $\mu_2^*$and $\mu_2$ , depending on whether or not he is promoted.

The worker who knows his own ability has a first period problem given by[9]

$$\underset{\mu_1}{Max}\ \alpha+\beta\ E(\mu_1+A+\varepsilon_1)-C(\mu_1) +Prob(A+\mu_1+\varepsilon_1>A^*)\ E\{\gamma+\delta(A+\ \mu_2^*+\varepsilon_2) - C(\mu_2^*))\}$$

$$+\ \ Prob(A+\varepsilon_1+\mu_1\ \leq A^*)\ E\{\alpha+\beta(A+\mu_2+\varepsilon_2)- C(\mu_2)\}$$

or

$$(7) \quad \underset{\mu_1}{Max}\ \ \alpha+\beta(\ \mu_1+A) - C(\mu_1)\ + [1-G\ (A^* - \mu_1 - A)]\ [\gamma + \delta\ (A + \mu^*_2) - C\ (\mu^*_2)]$$

[9]The discount rate is assumed to be zero.

$$+ G (A^* - \mu_1 - A) [\alpha + \beta (A + \mu_2) - C (\mu_2)] \quad .$$

The first-order condition is

$$(8) \qquad \beta - C\mathbb{N}(\mu_1)+g(A^*-\mu_1 -A) \{[\gamma+\delta(A+\mu_2^*)-C(\mu_2^*)] - [\alpha+\beta(A+\mu_2 )-C(\mu_2 )]\} = 0 \qquad .$$

Efficient effort is supplied when workers set $C\mathbb{N}(\mu_1) = \beta$. According to the first-order condition in (8), this occurs only when the last term on the l.h.s. is equal to zero. In general, it will not be zero. In fact, the last term is positive, implying over-investment, when

$$[\gamma+\delta(A+\mu_2^*) - C(\mu_2^*)] \quad > \quad [\alpha+\beta(A+\mu_2) - C(\mu_2)) ] \qquad .$$

Sufficiently high-ability workers prefer job 1 because they earn more in job 1. As a result, they overwork in period 1 to enhance the probability that they will be promoted. Because the firm cannot distinguish effort from ability, workers who want to be promoted have an incentive to work too hard in order to fool the firm into believing that their ability levels are higher than they actually are.

Less intuitive, the converse is also true. Low-ability workers, i.e., those for whom A is sufficiently low so that

$$[\gamma+\delta(A+\mu_2^*) - C(\mu_2^*)] \quad < \quad [\alpha+\beta(A+\mu_2) - C(\mu_2)) ] \qquad ,$$

underwork.[10] These workers underachieve because they do not want to take the chance of being

[10]Since $\mu_2$ is independent of A, there is always an A sufficiently low to make this condition hold.

promoted. From their point of view, a promotion is bad because they are likely to earn less in the difficult job than in the easy job.

The intuition is quite clear. Because workers are paid a piece rate in the second period, they want to be in the job for which they are appropriately suited. To illustrate, suppose there were only two jobs in a university: secretary and professor. On average, professors are paid more than secretaries. But if a worker were told that as a professor, he would be paid only on the basis of the number of articles that he published in top journals, many workers would prefer to be secretaries. The lowest-ability workers would be particularly anxious to stay in the secretary job and would reduce their period 1 output accordingly so as to avoid being mistaken for professor material.

The workers who are most likely to distort their effort in period 1 are those for whom

$$g(A^* - \mu_1 - A)$$

is high (see eq. (8)) and for whom

$$| [\gamma+\delta(A+\mu_2^*) - C(\mu_2^*)] - [\alpha+\beta(A+\mu_2) - C(\mu_2))] |$$

is high. Under standard assumptions about the distribution of $\varepsilon$, in particular that

$$\lim_{\varepsilon \to -\infty, \infty} g(\varepsilon) = 0,$$

very high- and very low-ability workers choose the efficient level of effort in period 1. They have little to fear in terms of incorrect promotion decisions. The extremely able are almost certain to be promoted, so that extra effort has very little effect on the probability of promotion. Conversely, the totally inept are almost certain to avoid promotion, so that reducing effort has almost no effect on lowering the probability of promotion.

Also true is that those whose underlying ability is very near the efficient job switch point (x in figure 1) do not distort effort much. Even if they are misclassified, they have little to lose. Indeed, those at the switch point are indifferent between the two jobs so the second term in (8) is zero either when A is close to the ability switch point or when the workers are extremely high or extremely low ability. The pattern of distortion is shown in figure 2. Those at the switch point do not distort at all. Those at the ability extremes to do not distort. Those with ability less than the switch point underwork and those with ability more than the switch point overwork.

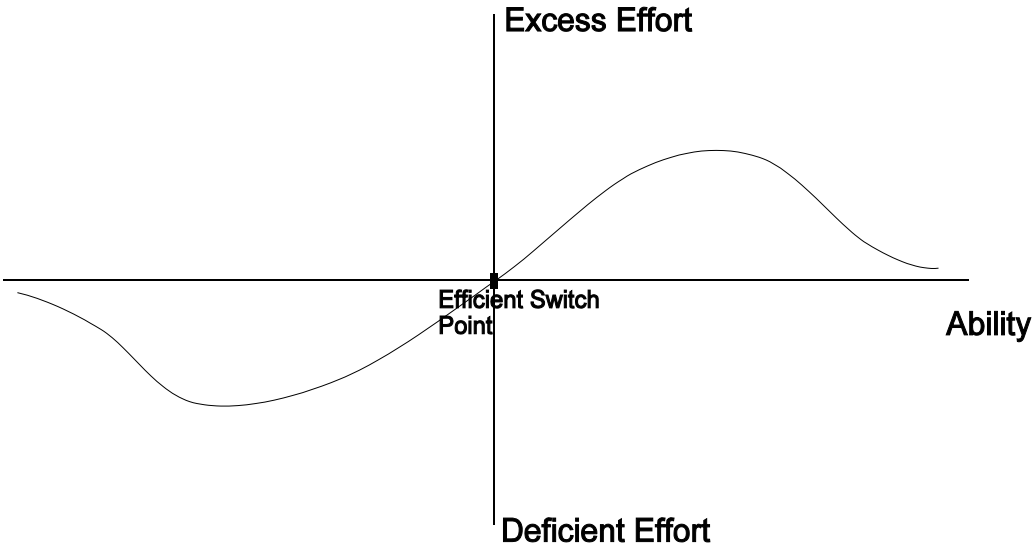



Figure 2

**2. Tournaments**

The usual intuition that most have about promotions inducing atypically high effort in period 1 comes from a tournament-like payment structure.[11] When period 2 wages depend on the job rather than the output in the job, all workers, even low-ability ones, put forth more effort than they would in the absence of period 2 promotion concerns.

The intuition holds whether the tournament is against another player or against a standard. In a tournament against a standard, wages in period 2 are fixed in advance and depend only on promotion. Even if workers receive no wage prior to promotion, they put forth effort in order to maximize

$$(9) \qquad \underset{\mu_1}{Max} \; W_d \Pr(A + \mu_1 + \varepsilon_1 > A^*) + W_e[1 - \Pr(A + \mu_1 + \varepsilon_1 > A^*)]$$

where $W_d$ is the difficult job's wage and $W_e$ is the easy job's wage.

The first-order condition is

$$(W_d - W_e)\frac{\partial \Pr(A + \mu_1 + \varepsilon_1 > A^*)}{\partial \mu_1} = C'(\mu_1)$$

or

[11]Here again, Rosen is instrumental. The first paper on the subject is Lazear and Rosen (1981).

$$(10) \qquad (W_d - W_e)g(A^* - \mu_1 - A) = C'(\mu_1) \quad .$$

The firm can obtain any level of effort, $\mu_1$, simply by setting the spread between the difficult job wage and easy job wage appropriately. Then it is only necessary to set the expected wage sufficiently high to attract the marginal worker.[12]

It is impossible to obtain efficiency even in period 1 with a tournament structure. The efficiency condition is that $C'(\mu_1) = 1$ for all workers, which requires that the spread is set such that

$$(W_d - W_e) = 1 / g(A^* - \mu_1 - A)$$

for all workers. But since g( ) depends on A, satisfying the condition for one ability level $A_0$ will not, in general, satisfy it for all other ability levels A ...$A_0$. As a general proposition, the tournament structure induces more than the efficient level of effort for some workers and less than the efficient level of effort for others.[13]

What is clear, however, is that effort in period 1 exceeds that in period 2. The tournament

[12]Higher-ability workers earn rents.

[13]The reason for using tournaments is not so much that it guarantees efficiency with heterogeneous workers, but rather that relative comparisons are easier to make than absolute assessments of output.

structure induces individuals to work at some positive level in period 1, but to reduce effort in period 2. In this stylized model, since there is no contingent reward in period 2, effort falls to zero. But the general point is that the tournament against a standard creates incentives to perform better in the pre-promotion period than in the post-promotion period.

Firms understand that their compensation schemes induce strategic behavior by workers and set A* accordingly. Although this may mitigate the effects of the behavior, it in no way changes the results of this section. Since all derivations hold for any given A*, they hold for the A* chosen to take these effects into account.

As is the case in the tournament against a standard, workers put forth more effort before the promotion decision than after the promotion decision in a tournament against another player. This follows directly from Lazear and Rosen (1981), where effort during the contest period exceeds effort after the contest period. Worker effort during the contest period is monotonically increasing in the spread between the winner's wage and the loser's wage. After the contest has been decided, effort falls off.

In both the tournament story and the regression-to-the-mean story, worker output declines after the promotion decision. In the tournament context, it is because effort declines. In the regression-to-the-mean version, it is because of the statistical proposition that ensures that winners do worse after promotion. There is a difference, however. In tournaments, even losers reduce effort after the promotion has been decided, so expected output for all workers falls over time. In the statistical version, winners' output fall and losers' output rise above their pre-promotion levels on average. This point is discussed in more depth below.

## C. Other Issues

### 1. Occupational Choice

The previous structure allows the worker to choose effort and the firm to assign a worker to the job. But it is possible to allow the worker to choose both job and effort. Indeed, if workers have information about their own ability that firms do not have and if output is perfectly observable, then the optimal scheme allows workers to choose both job and effort. Firms simply allow the worker to choose the occupation choice and to couple that with payment of a straight piece rate.

When workers know their ability, they can always be induced to do make the right choice, both in terms of job and effort, simply by paying them on their basis of their output. Rather than having a probation period, the worker can be asked which job he prefers. Individuals for whom

$$(11) \qquad \int_{-\infty}^{\infty} (\gamma + \delta(A + \varepsilon + \mu^*))g(\varepsilon)d\varepsilon \; - \; C(\mu^*) \; > \; \int_{-\infty}^{\infty} (\alpha + \beta(A + \varepsilon + \mu))g(\varepsilon)d\varepsilon \; - \; C(\mu)$$

choose the difficult job. Those for whom the condition in (11) does not hold choose the easy job. Effort levels in (11) are merely the optimal levels, given the job chosen, i.e., $\mu$ is the optimal level of effort, given that the easy job is chosen so $\mu$ is the solution to (4) and (6), respectively. Note that time subscripts are deleted because there is no longer any reason to split the worklife into pre- and

post-promotion. The job chosen at the beginning of the career is appropriate throughout.[14]

Because the expectation of ε is zero, (11) can be rewritten as

(12) $\alpha + \beta(A+\mu) - C(\mu) \quad < \quad \gamma + \delta(A+\mu^*) - C(\mu^*)$ .

If the condition in (12) holds, a worker prefers the difficult job. If it does not, the easy job is selected.[15] This is the same as the efficiency condition so workers choose jobs and effort efficiently under these conditions.

In a tournament against a standard, workers cannot be allowed to choose the job because they would always prefer the difficult job since it pays $W_d > W_e$. Thus, the issue is whether a tournament would ever be used instead of a piece rate.

The analysis implies that strategic underproduction cannot be a major factor. In order for this to be prevalent, it must be that low-ability workers who will be paid a piece rate post-promotion fear that they will be mis-classified into the difficult job when the easy job is actually appropriate. If this is the fear, an easy solution is simply to allow the worker to choose his job. If output is observable and a piece rate can be paid, it has already been shown that workers choose jobs efficiently. There is no reason for the firm to make inappropriate job assignments when workers have the information

---

[14] Human capital accumulation and other reasons for changing jobs are ignored.

[15] In a competitive market with rising supply price for workers (because they are distinguished by ability), firms earn zero profit. The marginal worker is the one for whom ability $A_0$ is low enough that

$\alpha + \beta(A_0 + \mu) - C(\mu) = 0$ .

and appropriate incentives can be constructed.

To the extent that effort-based strategic overproduction is an issue, it only arises when tournaments dominate and then only for some workers. The usual argument in favor of tournament-style compensation has to do with the observability of output. If it were cheaper to obtain an unbiased estimate of rank than of individual output, then a competitive tournament may dominate paying a piece rate. Similarly, if it were cheaper to ascertain that output had exceeded a certain standard than to obtain an unbiased estimate of actual output, then a tournament against a standard may be used. To the extent that firms prefer to set basic hurdles that must be exceeded for promotion, then strategic overproduction may occur for some workers and strategic underproduction for others because the firm cannot guarantee first-best for all ability levels.

**2. The Peter Principle in Reverse**

Just as those who are promoted have higher-than-average pre-promotion transitory error, $\varepsilon_1$, so do those who fail to be promoted have lower-than-expected transitory components. Other things equal, this implies that those who do not get a promotion should do better after being turned down than they did before. Thus, faculty who are denied tenure and move to other schools should do better on average at those other schools than they did when they were assistant professors at the first institution.

Observing this effect may be difficult for a number of reasons. For example, a worker's output might depend on the individuals with whom he works. In an up-or-out context,[16] those who fail to be promoted may find that the complementary factors in the new job are not as productivity-

[16]See Kahn and Huberman, (1988).

enhancing as those in the first job. Furthermore, motivation is an issue. To the extent that an individual believes that he is in the running for promotion, tournament effects are present, inducing effort. After the promotion has been denied, the incentives vanish, reducing effort and output.

**3. Another Interpretation of the Peter Principle**

Rosen (1986) presents a model of sequential promotions where individuals are sorted by ability at each stage such that the entering class at each round of a tournament are of equal (ex ante) ability. Rosen uses the model to determine the optimal compensation at each level to motivate workers. Sorting is also an issue because the pool of workers at successive rounds have higher ability than earlier rounds. The Rosen model is in some ways more general than the one described here because it allows for effort as well as ability differences. The focus is quite different, however, because neither the optimal promotion rule nor the worker's output over time is an important part of the analysis. It is likely that many of the Peter Principle results that come out of this paper could have been derived in that important paper on sequential promotions.

Still, the Rosen model does not fit one of the most common interpretations of the Peter Principle, which is that workers are promoted to their level of incompetence because a worker who is good in one job is not necessarily good in a job one level up. Fine professors do not necessarily make good deans (although not all would interpret moving to the dean's job as a promotion).[17] A slight modification of the definitions above and some of the formulas permit this interpretation.

To see this, allow $\varepsilon_1$ to be defined as the job-specific component of ability associated with the

[17]Anderson, Dubinsky, and Mehta (1999) claim that the data reveal a Peter Principle for sales managers because the skills needed by salespeople are generally distinctly different from those needed by sales managers.

easy job and $\varepsilon_2$ as the job-specific component of ability associated with the difficult job. Individuals are assigned to the easy job in period 1 for the reason given before: Most are better at the easy job and in the absence of information, the easy job is the right assignment. After evaluation, $\hat{A}$ is observed and the worker is promoted or not. If he is not promoted, then his ability post-promotion is $A+\varepsilon_1$ . If he is promoted then his ability after promotion is $A+\varepsilon_2$.

Under this interpretation, workers who are not promoted have output that remains constant over time and equal to

$$\alpha + \beta(A+\varepsilon_1) \quad .$$

Those who are promoted have output equal to

$$\gamma + \delta(A+\varepsilon_2) \quad .$$

The argument of the first section holds:

$$E(\varepsilon_1 | A + \varepsilon_1 > A^*) = \int_{-\infty}^{\infty} \int_{A^*-A}^{\infty} \frac{1}{1 - G(A^* - A)} \varepsilon \, g(\varepsilon) f(A) d\varepsilon \, dA$$

$$= \int_{-\infty}^{\infty} E(\varepsilon \mid \varepsilon > A^* - A) f(A) dA$$

which is positive since f(A) is positive and the conditional expection of ε given ε greater than any

number is positive (because the unconditional expectation of ε is zero). But the expectation of $\varepsilon_2$ is zero for promoted workers because $\varepsilon_1$ and $\varepsilon_2$ are uncorrelated. As a result, expected ability is higher in pre-promotion than for promoted workers post-promotion.

This does not necessarily imply that output is lower after promotion because workers are in different jobs. On the contrary, if A* is chosen optimally, it must be the case that expected output for the promoted workers is higher in the difficult job than in the easy job. If it were not, it would be better to raise A* until expected output were higher. If this could never be obtained, then setting A* equal to infinity, i.e., never promoting anyone, would be optimal. Rather the point is that after promotion, the average promoted worker is not as able in the difficult job as he was in the easy job, i.e.,

$$E(A+\varepsilon_2 \mid \text{promoted}) < E(A+\varepsilon_1 \mid \text{promoted}) .$$

Also true is that within any job, those left behind and not promoted have lower average ability than those of their cohorts entering into that job. If there were a series of promotion rounds, then at every level, those who were not promoted would have a job-specific component that is negative. This can be seen simply by examining the first round, which can be thought of as a "promotion" from being out of the firm to being hired as a worker. (Individuals must exceed some standard in order to be hired.) Since it has already been shown that

$$E(\varepsilon_1 \mid A+\varepsilon_1 > A^*) > 0$$

and since $E(\varepsilon_1) = 0$, it must be true that

$$E(\varepsilon_1 \mid A+\varepsilon_1 \leq A^*) < 0 \quad .$$

They appear "incompetent" because within any given job, the actual ability of those who are not

promoted out of the job is lower than the unconditional expectation of ability for that job. Those who are left behind and become the long-termers are worse than those who come into the job. They are incompetent relative to the entry pool because the competent workers are promoted out of the job. In a tournament with enough steps, each competent worker would continue to be promoted until he too was incompetent, i.e., until $E(\varepsilon_t) < 0$ for those whose highest job attained is job t. This is the Peter Principle: Workers are promoted to their level of incompetence. Those who are "competent" are promoted again.

One difference between this interpretation of the Peter Principle and the one used in the rest of this paper is that output of those not promoted does not rise under the job-specific interpretation. Since $\varepsilon_1$ is a job-specific effect and not a transitory component, those who are not promoted have ability $A + \varepsilon_1$ in both periods.

**4. Other Examples of the Principle**

The regression-to-the-mean phenomenon that is observed as the Peter Principle in the labor market has other manifestations. For example, it is often observed that sequels are rarely as good as the original movie on which the sequel is based. If each movie is thought of as having a theme-constant component, A, and a transitory component associated with each particular film, $\varepsilon_t$, then the same analysis holds. In order for a sequel to be made, the value of the original film must be estimated to be greater than A*. But given that the value exceeds the threshold level, A*, the expectation of the value of the sequel will be less than the original simply because

$$E(\varepsilon_1 \mid \text{sequel is made}) > 0,$$

but

$E(\varepsilon_2 \mid \text{sequel is made}) = 0.$

As a result, an original film must be sufficiently good to generate a sequel because studios adjust upward their cutoff levels, knowing that the second film is likely to be inferior to the first.

It is straightforward to test this proposition. Among other things, it implies that measures of film quality such as academy awards or ticket sales should be higher on the original film than on the sequels.[18]

Similarly, the first meal in a good restaurant is often the best, followed by less satisfying repeat visits. Just as above, think of A as the restaurant-specific component of the first meal and $\varepsilon_1$ as the transitory component of the meal itself. A second visit to the restaurant is made only if

$A + \varepsilon_1 > A^*$ .

Once again, the expected value of the second meal lies below that of the first, conditional on deciding to make a second visit to the restaurant. The larger is the transitory component (reflecting different chefs, different dishes, or random variations in quality), the larger is the discrepancy between first and second meal and the higher is the standard set to merit a second visit.

The point can also be used to explain why favorite restaurants go out of fashion. A restaurant becomes a favorite in part because of the permanent component (e.g., good recipes and an insightful owner) and in part because of potentially transitory components (e.g., the current chef and the service of the staff). A favored restaurant can be thought of as one that has gotten a draw of $A + \varepsilon_1 > A^*$.

[18]A countervailing effect is the notoriety that is created by the first film, which makes it easier to sell tickets on the sequel than on the original. Even if consumers understand that the sequel is worse than the original, more tickets might be sold on the sequel if, say, the actors and director are not well-known before the first film is made.

It is favored precisely because the value of the output exceeds some standard. Over time, $\varepsilon_1$ is replaced by transitory effects, the expectation of which is zero. The quality falls and the restaurant goes out of fashion.[19]

**5. Length of Probationary Period and Relative Importance of the Transitory Component**

The longer a firm waits to make a promotion decision, the better the information. One would expect that transitory components that bias a decision could be reduced or eliminated if the firm waited long enough to make a promotion decision. The cost of waiting, however, is that workers are in the wrong job for more of their lifetimes. For example, suppose that it were possible to get a perfect reading on *A* by waiting until the date of retirement. The information would have no value because the worker would have spent his entire working career in the easy job, even if he were better suited to the difficult job. The tradeoff is modeled. The conclusion is that as the variance of $\varepsilon_1$ rises, it becomes more valuable to wait on a promotion decision.

To see this, let us add one period to the previous model (without effort). Now, $\varepsilon_1, \varepsilon_2,$ and $\varepsilon_3$ refer to the transitory component in periods 1, 2 and 3 and assume that they are distributed i.i.d. and to reduce notation, that E(A)=0. Suppose that by waiting two periods, an employer can obtain a perfect reading of *A*. Under those circumstances, the optimum is simply to promote all and only

[19]This is not merely a story of winner's curse, although there is some overlap with that literature (see Wilson 1969). Winner's curse usually relates to a reading relative to other's reading rather than the time dimension of taking multiple readings, sometimes in different settings. The transitory versus permanent component is central to the discussion of this paper, but not the theme of most of the winner's-curse literature.

Actually, loser's curse is as important to the assignment problem as is winner's curse. In the job context, the goal is to assign a worker to the right job. Workers who do not satisfy the promotion criterion are, on average, undervalued just as those who are promoted are overvalued. The optimal selection of the cutoff point trades off the two kinds of errors.

those for whom $A$>x. The cost is that when the firm delays its promotion decision to the end of period 2, all workers are in the easy job during period 2 even though it might be better to place some in the difficult job in period 2. Expected output over the lifetime is then

(13)

$$\begin{aligned} \textit{Expected Output if Wait} &= 2(\alpha + \beta E(A + \varepsilon_1)) + \int_x^{\infty} (\gamma + \delta A) dF + \int_{-\infty}^{x} (\alpha + \beta A) dF \\ &= 2\alpha + \int_x^{\infty} (\gamma + \delta A) dF + \int_{-\infty}^{x} (\alpha + \beta A) dF \end{aligned}$$

The alternative is to make a decision after one period, using imperfect information and recognizing that sorting will be imperfect. To make things simple, assume that a firm that makes a promotion decision at the end of period 1 cannot reevaluate at the end of period 2. The gain is that workers are sorted early so that very able people can be put in the difficult job more quickly. The cost is that more errors are made in assigning workers to jobs. Then, expected output over the three periods is

(14)

$$\begin{aligned} \textit{Expected Output Early} &= (\alpha + \beta E(A + \varepsilon_1)) + 2\int_{-\infty}^{\infty} \int_{A^* - \varepsilon}^{\infty} (\gamma + \delta A) dF dG + 2\int_{-\infty}^{\infty} \int_{-\infty}^{A^* - \varepsilon} (\alpha + \beta A) dF dG \\ &= \alpha + 2\int_{-\infty}^{\infty} \int_{A^* - \varepsilon}^{\infty} (\gamma + \delta A) dF dG + 2\int_{-\infty}^{\infty} \int_{-\infty}^{A^* - \varepsilon} (\alpha + \beta A) dF dG \end{aligned}$$

In an extreme case, it is clear that it pays to decide early. If the distribution of ε is degenerate so that there is no error, then (14) becomes

$$(15) \qquad \textit{Expected Output Early} = \alpha + 2\int_{x}^{\infty}(\gamma + \delta A)dFdG + 2\int_{-\infty}^{x}(\alpha + \beta A)dF$$

The r.h.s. of the expression in (15) must exceed the r.h.s. of (13) because

$$\gamma+\delta A > \alpha+\beta A \qquad \text{for} \quad A>x$$

since that is how x is defined. Thus, when the variance in ε shrinks to zero, it always pays to promote early.

The example used earlier shows that it sometimes pays to defer the promotion decision until the end of period 2. As before, let α=1, β=.5, γ=0 and δ=1, where the distributions of A and $\varepsilon_t$ are normal with variance equal to one. As shown earlier, the optimal cut point is A*=4.01. Then, the r.h.s. of (13) equals 3.004. The r.h.s. of (14) is 3.000. Thus, deferring the promotion decision until the second period pays when the variance in ε is 1. Other numerical examples show that the advantage of deferring the promotion decision becomes larger for higher variances in ε.

The general point is that when the distribution of ε is sufficiently tight, it pays to make the promotion decision early. When it is sufficiently diffuse, it pays to make the promotion decision later. Later promotion decisions are more accurate, but result in workers' spending a longer proportion of their worklife in the wrong job.

## Conclusion

Workers who are promoted (or hired in the first place) receive this treatment because they are observed to have exceeded some standard. Part of the observation is based on lasting ability, but part is based on transitory components that may reflect measurement difficulties, short-term luck, or skills that are job specific. As a result, there is regression to the mean, creating a "Peter Principle." Workers who are promoted do not appear to be as able as they were before the promotion.

Firms take this phenomenon into account in setting up their promotion rule. Under general conditions, when fewer than 50% of the workers are better suited to the high level job, the firm adjusts the promotion standard upward to compensate for the regression to the mean. The amount of the adjustment depends on the tightness of the error distribution. When the pre-promotion error has high dispersion, promotion standards are inflated by more than they are when the error dispersion is low.

The statistical argument has been contrasted with incentive arguments. Whether workers over-produce because they are gaming the system depends on the payment structure. If, for example, workers were paid on the basis of output both before and after the promotion decision, those who were able would over-produce, but those who were less able would under-produce before the production decision was made. Each type of worker wants to be avoid being mis-classified into the wrong job and exaggerates the pre-promotion reading on ability to avoid being put in the wrong job. If workers have knowledge of their own ability, underproduction is not likely to be a problem, because when a piece rate is used, the worker can simply be permitted to choose his job. Then allowing the worker choice eliminates strategic under- or over-production. When a tournament structure is chosen because of inability to observe output, workers produce more before promotion

than they do after promotion.

The Peter Principle can be interpreted as ex-post unhappiness with a promotion decision, either because workers are not as good as perceived before promotion or because they were better in their prior job relative to their peers than they are in their current one. In a multi-level firm, virtually all workers who remain at a given level will be "incompetent" in that they are not as good as the average worker coming into the job, nor are they as good as they were in their previous job relative to their comparison set.

One way to offset the Peter Principle is to wait for a longer time before making a promotion decision. The advantage is that the job assignment is better than it would have been had the decision been made earlier. The disadvantage is that able workers remain in the wrong job for a longer period of time.

The logic of the Peter Principle applies in other contexts as well. The regression-to-the-mean phenomenon implies that movie sequels are lower quality than the original films on which they are based and that excellent restaurant meals are followed by ones that are closer to mediocre.

## References

Anderson, Ralph E., Alan J. Dubinsky, and Rajiv Mehta. "Sales Managers: Marketing's Best Example of the Peter Principle?" *Business Horizons,* 4, 2, 1, 19 (1999), 19-26.

Baker, George, Michael Gibbs and Bengt Holmstrom. "The Internal Economics of the Firm: Evidence from Personnel Data," *Quarterly Journal of Economics,* November, 1994: 881-919.

Fairburn, James A. and James M. Malcomson. "Performance, Promotion, and the Peter Principle," *Review of Economic Studies*, forthcoming, 2000.

Faria, Joao Ricardo. "An Economic Analysis of the Peter and Dilbert Principles," Unpublished manuscript, University of Technology, Sydney, Australia, (2000).

Gibbons, Robert and Michael Waldman. "A Theory of Wage and Promotion Dynamics," *Quarterly Journal of Economics,* 114: 4 (November 1999) 1321-58 .

Gibbs, Michael and Wallace Hendricks. "Are Formal Salary Systems a Veil?" University of Chicago,
August, 2001.

Jovanovic, Boyan. "Job Matching and the Theory of Turnover," *Journal of Political Economy* 87 (October 1979): 972-90. (1979a)

Jovanovic, Boyan. "Firm-Specific Capital and Turnover," *Journal of Political Economy* 87 (December 1979): 1246-60. (1979b)

Kahn, Charles, and Huberman, Gur. "Two-Sided Uncertainty and `Up-or-Out' Contracts," *Journal of Labor Economics* 6 (October 1988): 423-44.

Lazear, Edward P. ``The Job as a Concept," in *Performance Measurement and Incentive Compensation*, ed. William J. Bruns, Jr. Cambridge: Harvard Business School Press, 1992.

Lazear, Edward P. "Raids and Offer-Matching," in Ehrenberg, Ronald, ed. *Research in Labor Economics,* Vol. 8, 1986, part A: 141-65.

Lazear, Edward P., and Rosen, Sherwin. ``Rank-Order Tournaments as Optimum Labor Contracts," *Journal of Political Economy* **89** (October 1981): 841-64.

Medoff, James, and Abraham, Katharine. ``Experience, Performance, and Earnings," *Quarterly Journal of Economics* **95** (December 1980): 703-36.

Peter, L.J. and R. Hull. *The Peter Principle: Why Things Always Go Wrong.* New York: Morrow (1969).

Rosen, Sherwin. ``Prizes and Incentives in Elimination Tournaments," *American Economic Review* **76** (September 1986): 701-15.

Wilson, R., "Competitive Bidding with Disparate Information," Management Science, Vol. 15, No. 7 (March 1969), pp. 446-448. Reprinted inSteven A. Lippman and David K. Levine (eds.), The Economics of Information, Edward Elgar Publishing, London, 1994; and Paul Klemperer (ed.), The Economic Theory of Auctions, Edward Elgar Publishing, London, 1999.