Theory and evidence in internal labor markets

Waldman, Michael

Cornell University

1 October 2007

THEORY AND EVIDENCE IN INTERNAL LABOR MARKETS

(Draft Chapter for the Forthcoming *Handbook of Organizational Economics*)

By

Michael Waldman
Johnson Graduate School of Management
Cornell University
Sage Hall
Ithaca, NY 14853
(607) 255-8631
mw46@cornell.edu

October 2007

ABSTRACT

A number of branches of the literature on internal labor markets have matured to the point that there is now a healthy two-way interaction between theory and empirical work. In this survey I consider two of these branches: i) wage and promotion dynamics; and ii) human-resource practices. For each case I describe the empirical and theoretical literatures and also discuss what we can learn by paying careful attention to how theoretical and empirical findings are related. In addition to surveying the literatures on these two topics, my goal is to show how a deeper understanding of internal-labor-market phenomena can be derived from a close partnering of empirical and theoretical research.

I. INTRODUCTION

During the last 30 years economics has made great progress in moving beyond treating the firm as a "black box" and understanding various aspects of its internal operation. One area, in particular, where substantial progress has been made is that of internal labor markets.[1] In this paper I do not broadly survey the now extensive literature on this topic (see Gibbons (1997), Lazear (1999), Gibbons and Waldman (1999a), and Lazear and Oyer (2007) for broad-based surveys), but rather focus on connections between theory and evidence in this literature. In particular, pursuing a theme first explored in Gibbons and Waldman (1999a), I explore the extent to which patterns of empirical evidence can be used to choose between competing theories.

Most of the early literature on internal labor markets was theoretical and these papers typically fall under one of two main approaches. One approach was to identify and model a fundamental factor concerning the operation of internal labor markets. Some of the important contributions that fall in this category include Becker (1962,1964) on human capital, Holmstrom (1979,1982) and Shavell (1979) on agency theory, and Rosen (1982) on the allocation of workers across an employment hierarchy. Clearly these are important contributions that established some of the main building blocks that later theoretical contributions rely upon. But mostly these papers were not focused on the empirical literature and, in particular, the extent to which the models developed are able to capture important empirical relationships.

The second approach was more closely tied to the empirical evidence in that the focus was typically providing an explanation for an important empirical phenomenon. Important papers here include Lazear's (1979) model of mandatory retirement, Lazear and Rosen's (1981) seminal model of labor-market tournaments that provides an explanation for why promotions are typically associated with large wage increases, and Waldman (1984a) which explores the

---

[1] Doeringer and Piore (1971) originally utilized the term "internal labor market" to refer to the human-resource practices of a firm (or part of a firm) that employs ports of entry, promotion from within, wages attached to jobs, and job ladders. Their analysis focused mostly on blue-collar settings and was mostly descriptive rather than based on statistical analysis. Consistent with more recent literature, I use the term to refer to various issues concerning a firm's labor force when the labor force exhibits long-term attachments to the firm. With this usage the term can be used to describe either blue- or white-collar settings. Alternative terminology would be to refer to "personnel economics" or "careers in organizations" rather than "internal labor markets."

signaling role of promotions and provides a competing explanation for large wage increases upon promotion. In addition to these papers providing explanations for important real-world phenomena, these papers have also served as important building blocks.

But as the literature has matured, two related questions have become central. First, when there are competing plausible theories for an empirical phenomenon, which one best captures the correct real-world explanation for the phenomenon. For example, both tournament theory and promotions serving as signals provide plausible explanations for why promotions are typically associated with large wage increases. How should we choose between these competing theories, or possibly, what would lead us to conclude that both are at work? Second, empirical phenomena should not be viewed in isolation. If, for example, tournament theory is the correct explanation for large wage increases at promotion, then this has implications for the correct explanation for other internal-labor-market phenomena. In other words, many of these phenomena are inherently intertwined, so there should be a single model or a set of related models that explain related phenomena rather than a completely different model for each fact.

Much of the more recent literature makes progress on these issues in one of two ways. First, on the empirical side, rather than focusing on a single empirical fact or phenomenon, many papers focus on presenting a pattern of evidence concerning related issues. Early papers I would place in this category are Medoff and Abraham's (1980,1981) papers concerning the relationship between performance evaluations and wages. More recent important papers in this category include Baker, Gibbs, and Holmstrom's (1994a,b) papers on wage and promotion dynamics and Ichniowki, Shaw, and Prennushi's (1997) investigation of human-resource practices.

Second, a number of more recent theoretical studies focus on whether the theoretical model is consistent with patterns in the empirical evidence rather than a single fact or empirical phenomenon. Examples of papers that take this approach are Milgrom and Roberts (1990), Bernhardt (1995), and Gibbons and Waldman (1999b,2006). Milgrom and Roberts (1990) shows how complementarity across work practices can explain various standard findings in the empirical literature concerning innovative work practices, while Bernhardt (1995) and Gibbons

and Waldman (1999b,2006) provide models that explain various findings in the empirical literarture concerning wage and promotion dynamics inside firms.

This survey focuses on this agenda. That is, it focuses on how we can use patterns of evidence concerning various internal-labor-market issues to choose between plausible alternative theoretical approaches, where not surprisingly sometimes the evidence points towards a combination of theories being the right answer. I also try to highlight what are the open questions. Also, given the focus of the paper, rather than choosing to do a comprehensive survey, I consider specific topics within the broad literature on internal labor markets for which the literature is sufficiently mature that focusing on patterns of evidence and theories that can address these patterns is a worthwhile exercise.

The two specific topics I consider are wage and promotion dynamics and human-resource practices. Sections II and III consider the literature on wage and promotion dynamics. Section II surveys empirical evidence including basic empirical findings, the role of schooling, and the role of performance evaluations. Section III then discusses four candidate models for explaining the evidence and also provides an overview and synthesis. Sections IV and V consider the literature on human-resource practices. Section IV surveys the evidence focusing on the nature of the various types of evidence, and then more specifically the evidence concerning the effects of adoption and patterns of adoption of innovative-human-resource practices. Section V then discusses relevant theories. Section VI considers international differences in internal-labor-market operation, where most of these differences are closely linked to differences in human-resource practices. Here most of the focus is on US-Japanese differences and the various theoretical models that have been put forth to explain those differences. Section VII concludes.

II. EMPIRICAL EVIDENCE ON WAGE AND PROMOTION DYNAMICS

This section starts with a discussion of basic empirical findings and then follows with discussions of the role of schooling and of performance evaluations. Some of the evidence

concerning wage and promotion dynamics are found in tests of specific theoretical models. Much of this evidence is discussed in Section III which focuses on theory.

A) <u>Basic Empirical Findings</u>

Although most of the findings in this subsection appear in Baker, Gibbs and Holmstrom's (1994a,b) in-depth empirical analysis of a single firm's wage and promotion practices based on personnel records, most of the focus is on findings with support both there and elsewhere. Other important papers in this literature include Lazear (1992), McLaughlin (1994), McCue (1996), and Podolny and Baron (1997). Note that some of these studies are similar to Baker, Gibbs, and Holmstrom's study in that the focus is on a data set drawn from a single firm's personnel records, while others analyze data drawn from broader cross-sections. Also, like Baker, Gibbs, and Holmstrom, a number of the studies focus on the internal-labor-market careers of white-collar workers while others consider both blue- and white-collar workers. For each finding I provide a list of of papers that find supporting evidence (and where appropriate papers that find contradictory evidence), but because of the rapid growth in this literature in recent years I do not attempt to make an exhaustive list for each finding.

The first finding is that real-wage decreases are not rare, but nominal-wage decreases and demotions are. That real-wage decreases are not rare has been found in a number of studies including Baker, Gibbs, and Holmstrom (1994a,b), McLaughlin (1994), and Card and Hyslop (1997). Baker, Gibbs, and Holmstrom find that the frequenciy of real-wage decreases is higher in high-inflation environments which suggest some type of lag in the wage-adjustment process, but some real-wage decreases are seen even when inflation is low. The same papers find evidence of a low rate of nominal wage decreases. On the other hand, although less well documented outside of the Baker, Gibbs, and Holmstrom study, I take it as uncontroversial that demotions are typically rare. Although Dohmen, Kriechel, and Pfann (2004) focus on a declining firm – Fokker Aircraft – and find that demotions can be substantial during a decline.

A second finding with significant empirical support is serial correlation in promotion rates, i.e., a worker promoted quickly from say level one to level two will on average earn promotion to level three more quickly. This is sometimes referred to as a fast track. Support for this can be found in Rosenbaum (1984), Baker, Gibbs, and Holmstrom (1994a,b), and Podolny and Baron (1997). In an interesting recent paper Belzil and Bognanno (2004) use a structural-estimation approach to investigate the more detailed question of what drives fast tracks. They find that conditional on unobservables, a worker's promotion probability is only slightly higher when the worker was promoted more quickly in the past, where the magnitude of this effect is larger for workers with lower levels of education.

A third finding where the evidence is a bit more mixed is that of serial correlation in wage increases. There is strong evidence for this finding in papers focused on relatively homogeneous samples such as Baker, Gibbs, and Holmstrom's analysis of the managerial workforce of a single firm, the Lillard and Weiss (1979) study of American scientists, and Hause's (1980) study of young Swedish males. A number of studies such as Abowd and Card (1989), Topel (1991), and Topel and Ward (1992) do not find evidence of serial correlation in wage increases looking at heterogenous samples such as the PSID. One exception is Baker (1997) who finds serial correlation in wage increases using the PSID, but he considers a larger panel than other studies and also uses alternative econometric tests.

Another finding with strong support is that promotions are associated with large wage increases. This has been found in numerous studies including Lazear (1992), Baker, Gibbs, and Holmstrom (1994a,b), and McCue (1996). A little surprising given the strong evidence for this finding is that there is also strong evidence for wage increases at promotion being small relative to the differences between average wages across adjacent job levels. This has been found in papers such as Baker, Gibbs, and Holmstrom (1994a,b), Murphy (1985), and Main, O'Reilly, and Wade (1993). Although at first these two findings may seem contradictory, as will be discussed in more detail later, they are actually easy to reconcile given that on average wage changes are positive in periods where no promotions occur.

The last two findings have less support in the literature, but this is possibly because there has been less study of these issues. The first is that large wage increases early at a job level predict subsequent promotions. This is found in Baker, Gibbs, and Holmstrom (1994a,b) and evidence along this line is also found in McCue (1996). The last finding is that wages exhibit cohort effects, i.e., a cohort's wage as it ages depends to an extent on the average starting wage even after controlling for composition differences across cohorts. This is found in Baker, Gibbs, and Holmstrom (1994a,b) and, more recently, in Kahn (2006), Oyer (2006), and Oreopoulos, von Wachter, and Heisz (2006) which look at economy-wide cohort wages or industry-level cohort wages. Also, although their specific findings are a bit different, related findings that cohorts matter appear in Beaudry and DiNardo (1991) which is discussed in more detail later.

B) <u>The Role of Schooling</u>

This subsection discusses empirical findings that specifically relate to the role of schooling in wage and promotion dynamics. The first result which I take as noncontroversial so I do not list papers that find the result is that schooling positively affects the starting wage. Certainly, if this were not the case, many of us would likely be unemployed since the demand for undergraduate and graduate teaching would be significantly reduced.

A second finding is that schooling is positively related to promotion probabilities. Supporting evidence for this can be found in Baker, Gibbs, and Holmstrom (1994a,b), McCue (1996), and Lluis (2005), although McCue's study which focuses on the PSID finds a statistically significant relationship only for white men; for other demographic groups the coefficients are typically positive but statistically insignificant. Lluis (2005) also shows a related finding. As will be discussed in the next section, one possible explanation for why schooling is positively related to promotion probabilities is that schooling is positively related to worker ability and worker ability is positively related to promotion probabilities. This suggests that if one were to control for worker ability, then the positive relationship between schooling and promotion probability should weaken. Lluis finds such a result. Specifically, when she includes

a lagged value of each worker's wage growth, which should be a noisy measure of ability, the

result is that

the positive relationship between schooling and promotion probabilities becomes weaker.

Another finding with strong support is that schooling is positively related to the wage even after controlling for experience and job assignment. This is found both by Medoff and Abraham (1980,1981) and Baker, Gibbs, and Holmstrom (1994a,b). In each case the authors run Mincerian regressions that include job level and find that schooling is positively related to the wage even after controlling for experience and job level.

The final finding which concerns evidence between schooling and the returns to experience is mixed. Farber and Gibbons (1996) using data from the NLSY regresses the wage level on various variables including schooling, experience and experience squared, a test score unobserved by employers, and various interaction terms including one between schooling and experience. When they include controls for changes in the return to education over time they find that extra schooling does not change the return to experience.[2] In contrast, Rubinstein and Weiss (2007) using three data sets – the CPS short panel, the PSID, and the NLSY – directly consider how earnings growth over various career intervals is related to schooling and find strong evidence that schooling is positively related to the return to experience. Also, in a recent paper using the CPS Habermalz (2006) allows for non-linearities and finds results consistent with schooling being positively related to the return to experience.[3]

C) The Role of Performance Evaluations

---

[2] An alternative approach is to use a log-wage specification explored in a large literature starting with Mincer (1974) (see Willis (1986) and Card (1999) for surveys). A standard finding in this literature is that the log wage is positively related to schooling which suggests that the absolute return to experience increases with schooling. But in his original study Mincer also adds an experience-schooling interaction and finds a significant negative coefficient. This findings throws some doubt on whether the return to experience is truly increasing with the education level.

[3] Gibbons and Waldman (2006) argue that the findings of Farber and Gibbons that the return to experience is not increasing with education may be due to the limited time period studied and that a longer sample might produce a positive relationship as found in these other studies.

The final set of facts I consider concerns the role of performance evaluations. Not that many papers have considered this topic so most of the results are taken from Medoff and Abraham's (1980,1981) classic studies. Most of the focus of the Medoff and Abraham studies was on a discrepancy between the manner in which wages depend on labor-market experience and firm tenure and the manner in which performance evaluations depend on labor-market experience and firm tenure. Specifically, they find that within a job wages are strongly positively related to labor-market experience and firm tenure, while performance evaluations are either unrelated or slightly negatively related to experience and firm tenure. In interpreting their results they question the idea that much of wage growth during careers is the result of accumulation of human capital, but as I discuss later there are other possibilities.

A second related finding is that the magnitude of the negative relationship between performance evaluations and labor-market experience depends on the specific manner in which the test is conducted. In particular, the negative relationship between performance evaluations and labor-market experience is larger in absolute value in cross-sectional analyses than longitudinal analyses on the same data set. This is found in Medoff and Abraham's work and in Gibbs (1995). As discussed in more detail later, this finding suggests that at least some of the negative relationship found in cross-sectional analyses is due to the sorting of workers across jobs and firms over time due to promotions and exits as workers age.

Another set of findings is that high performance evaluations today predict good outcomes in the future. Specifically, both Medoff and Abraham (1980,1981) and DeVaro and Waldman (2006) find that performance evaluations are positively related to future promotions and the size of future wage increases. As will be discussed in more detail later, DeVaro and Waldman consider how a worker's schooling level affects the relationship between performance evaluations and promotion probabilities. They find results consistent with the idea that the performance required to achieve a promotion falls with the worker's education level.

III. FOUR CANDIDATE MODELS

In this section I discuss four theoretical approaches that can be used to address or at least partially address the empirical facts presented in the previous section. These are: i) symmetric learning and insurance; ii) the tournament approach; iii) pure asymmetric learning/promotions as signals; and iv) symmetric learning with human capital acquisition and job assignment. At the end of the section I provide an overview and synthesis.[4]

A) <u>Symmetric Learning and Insurance</u>

This subsection discusses Harris and Holmstrom's (1982) model of symmetric learning and insurance.[5] As is made clear below, this model does well at capturing various facts concerning wage dynamics but, because of a lack of a hierarchical structure, it does poorly in terms of capturing facts that relate to promotions.

1) Basic Description

In Harris and Holmstrom's model workers vary in terms of their abilities, but within a schooling group (or some other attribute easily observable at time of labor-market entry) they look observationally equivalent upon entering the labor market. As time passes firms observe workers' outputs and update their beliefs concerning workers' abilities. Because of a stochastic component in the production function this learning is gradual, while because output realizations are public all firms have the same belief concerning a worker's expected ability in each period.

The other main aspect of the model concerns the contracting environment. Because workers are risk averse and firms are risk neutral, firms would like to insure workers against uncertainty concerning how beliefs about worker ability evolve over time. Harris and

---

[4] There are other theoretical approaches one might consider. These include the idea of delayed compensation as found, for example, in Becker and Stigler (1974) and Lazear (1979,1981), the efficiency wage argument as found, for example, in Calvo (1979,1985) and Shapiro and Stiglitz (1984), the idea of influence costs as found, for example, in Milgrom (1988) and Milgrom and Roberts (1988), and the idea of knowledge hierarchies as found, for example, in Garicano (2000), Garicano and Hubbard (2005), and Garicano and Rossi-Hansberg (2006). I focus on the four theoretical approaches that I believe are the strongest candidates for explaining the evidence.

[5] Harris and Holmstrom (1982) builds on the earlier work of Freeman (1977).

Holmstrom assume long-term contracting is feasible but also realistically that a worker cannot commit to not leave his or her current employer in order to accept a higher wage elsewhere.

Harris and Holmstrom show that equilibrium contracts consist of a downward rigid wage but there is a possibility that the wage will increase in the future depending on subsequent realizations of output. The downward rigid wage provides partial insurance, where full insurance is not feasible because of the inability of workers to commit to not leave for a later higher wage elsewhere. Further, at any point in time a worker's wage equals the worker's expected output minus an insurance premium the worker pays for the downward rigidity, where the size of this premium is negatively related to both worker age and the precision of beliefs concerning worker ability. The insurance premium falls with age because the expected cost of offering a wage floor is lower when there are less future periods in which the wage floor might exceed subsequent values of expected worker productivity. Similarly, it falls with the precision of beliefs about worker ability because the expected cost of a wage floor is lower when expected productivity is anticipated to vary little in subsequent periods.

2) Theoretical Extensions and Empirical Tests

A related theoretical analysis appears in Weiss (1984). In that analysis workers do not vary in terms of their underlying innate ability when they enter the labor market. Rather, realized productivity in any period is stochastic and expected productivity grows stochastically as workers age where expected productivity in any period is a positive function of previous productivity. In other words, high output now on average means higher outputs later. As do Harris and Holmstrom, Weiss considers the role of insurance contracts. Further, similar to Harris and Holmstron's conclusions, Weiss finds that under specific assumptions concerning mobility costs and access to capital markets the result is a downward rigid wage where wage increases can occur if the stochastic process eventually results in sufficiently high expected productivity.

There have been a few direct tests of the theory. Beaudry and DiNardo (1991) first extend the theory to consider the importance of past labor-market conditions on current wages. They find that a worker's current wage should be a positive function of the best labor-market conditions experienced since the worker was hired. This prediction contrasts with the spot contracting prediction that only current labor-market conditions should matter. They test the prediction using data from the CPS and the PSID and find supportive evidence. More recently, Grant (2003) investigates the same prediction using the NLS and finds supportive evidence.

A different test is investigated in Chiappori, Salanie, and Valentin (1999). They first extend Harris and Holmstrom's model to show that in subsequent periods "late beginners" do better than "early starters." That is, holding fixed the wage at date t, the wage at t+1 should be negatively correlated with the wage at t-1, i.e., higher recent wage growth should on average translate into higher subsequent wage growth. The authors then investigate this prediction using managerial data at a large French state-owned firm and find supportive evidence. However, one drawback of this test, which is discussed by Chiappori, Salanie, and Valentin, is that there an alternative explanation. The same prediction follows from a model in which wages equal expected productivity and changes in productivity growth are positively correlated over time.

3) Pros and Cons

There are a number of positives concerning this theory. First, it can explain the main Medoff and Abraham findings that wages on average rise with experience even though performance evaluations do not. That is, assume the absence of performance evaluations increasing with labor-market experience means average productivity does not increase with labor-market experience. Then the Harris and Holmstrom analysis exactly captures the Medoff and Abraham findings. In their model expected productivity is independent of labor-market experience since there is no human-capital accumulation. Yet, the average wage increases with labor-market experience because of the downward rigidity of wages and because, as discussed, the insurance premium falls with labor-market experience.

Second, the model is consistent with a number of findings concerning earnings growth not discussed in the previous section but which are found in the literature on the subject. For example, the model captures Mincer's (1974) findings that within a schooling group the variance of earnings increases with labor-market experience and that within schooling-experience groups the distribution of wages tends to be positively skewed. Third, as discussed above, a few papers have developed tests of the theory and those test have in general been supportive.

However, there are also significant negatives. Probably the most important is that the evidence is not consistent with the model's main prediction. In the Harris and Holmstrom setting firms insure workers against negative movements in beliefs concerning expected ability so wages are downward rigid, where the prediction is real-wage rigidity not nominal rigidity. But substantial evidence discussed in the previous section shows that the proportion of real-wage decreases is substantial. The other main problem with the model is that, because of its lack of a hierarchical structure or at least alternative job assignments, the model does not address the various empirical findings concerning promotions discussed in the previous section.

B) The Tournament Approach

Here I discuss the tournament approach to internal-labor-market compensation. This literature began with the seminal analysis of Lazear and Rosen (1981). Most of the discussion focuses on the Lazear and Rosen analysis, although I do discuss a few of the many extensions of that analysis. As is also discussed, there is clear empirical support for the main ideas underlying the tournament argument, but in general theoretical investigations have not explored the extent to which the theory can explain the large number of empirical findings concerning wage and promotion dynamics discussed above.

1) Basic Description

Lazear and Rosen (1981) consider a setting characterized by two risk-neutral identical

workers, where worker output is a function of effort and a stochastic term. In their world effort is not directly observable so a firm cannot base compensation on the effort choices of its workers. Instead the firm establishes a tournament. It commits to prizes for the winner and the loser, where the winner is the worker who produces more and the two prizes are independent of the difference between the outputs and the absolute levels of the outputs.

Lazear and Rosen show that the difference between the prizes, i.e., the spread, serves as an incentive for effort, where the larger the spread the higher is the equilibrium effort level. In turn, the equilibrium spread is the one that generates efficient effort levels. That is, because effort is costly for workers too much effort is not desirable, so the firm chooses a spread that equates the marginal disutility of effort with the extra productivity associated with effort. Lazear and Rosen interpret their results as providing an explanation for the large compensation increases associated with promotions. In this interpretation promotions and the associated higher compensation serve as prizes and lower level workers increase their effort levels because doing so increases the probability of receiving the prizes.

Lazear and Rosen also discuss and analyze the circumstances in which labor-market tournaments are preferable to alternative ways to motivate workers when effort is not directly observable. In the risk-neutral world that they begin with they show that tournaments and piece rates both yield first-best outcomes. They then argue that because the information requirements for conducting tournaments are less than for paying piece rates – the tournament only requires an ordinal ranking of the workers – tournaments may be preferred because they are less costly to conduct. Lazear and Rosen also consider what happens when workers are risk averse and argue that in some circumstances tournaments will be preferred to piece rates given risk aversion. I come back to this issue below.

2) Theoretical Extensions and Empirical Tests

There is a large literature extending Lazear and Rosen's (1981) analysis. A number of papers such as Green and Stokey (1983) and Nalebuff and Stiglitz (1983) focus on a comparison

between the efficiency or profitability of employing tournaments versus contracting directly on output. As was true of Lazear and Rosen's analysis of risk aversion, Green and Stokey's analysis and Nalebuff and Stiglitz's analysis do not focus on optimal contracts. Mookherjee (1984), on the other hand, shows that under risk aversion the optimal contract typically dominates the optimal tournament. This again raises the question of why tournaments are employed. In addition to Lazear and Rosen's answer to this question which concerns savings on information costs, Malcomson (1984) argues that tournaments may be employed because individual performance is not verifiable which makes individual contracting difficult to enforce.

Another important direction in which tournament theory has been extended concerns modeling a tournament that consists of several rounds or contests. Clearly, real-world promotion tournaments do not consist of a single competition for promotion, but rather over a worker's career promotion to a higher level job is soon followed by competition for a subsequent promotion. Rosen (1986) models a tournament along this line (see also Meyer (1992)). In Rosen's model pairs of workers compete against each other in a round and then the winners proceed to the next round where there is again competition amongst pairs of workers. The tournament ends when only a single winner remains. Under the strong assumption that worker effort is constant across rounds, Rosen shows that the wage increase associated with winning the last round of the tournament is larger than the increases associated with winning earlier rounds. The paper thus provides a potential explanation for why wage increases associated with being promoted to the very top levels of firms seems to be especially large as found, for example, in Murphy (1985) and Baker, Gibbs, and Holmstrom (1994a,b).

There is also a substantial literature focused on testing implications of the tournament model. One set of papers focuses on the prediction that worker effort should be positively related to the spread. Various papers, including Ehrenberg and Bognanno (1990a,b) who study professional golf tournaments, Becker and Huselid (1992) who study auto racing, and Audas, Barmby, and Treble (2004) who study promotion at a large British financial sector employer, find evidence consistent with this prediction. Although of interest, I find this particular set of

findings weak in terms of how strongly they support traditional tournament theory. Independent of whether firms design promotion practices with incentives in mind as in classic tournament theory, utility maximization should result in higher worker effort when the spread is larger.

A second set of papers focus on predictions concerning firm behavior. These predictions arise from extensions of the basic Lazear and Rosen model. The first prediction is that the spread or wage increase due to promotion should be positively related to the number of workers at the job level from which the promoted worker is drawn. The basic logic of this prediction is that increasing the number of workers competing for a promotion reduces equilibrium effort levels and the firm increases the spread as a response.[6] Main, O'Reilly, and Wade (1993), Eriksson (1999), and Bognanno (2001) find supporting evidence, while O'Reilly, Main, and Crystal (1988) find contradictory evidence.

A second firm-side prediction is the convexity of the wage structure derived in Rosen's (1986) analysis discussed above. Support for this prediction is found in Lambert, Larcker, and Weigelt (1993) and Eriksson (1999). Note that I find the general support for these two firm-side predictions more persuasive than the support for the worker effort prediction discussed above. The two firm-side predictions are more closely tied to the theoretical approach, so generally supportive empirical evidence is more persuasive. But even here there is a potential alternative explanation for the first of these predictions. That is, as discussed later, the idea that the wage increase due to promotion is potentially related to the number of workers at the job from which the promoted worker is drawn could be explained using the promotion-as-signal hypothesis.[7]

---

[6] See Prendergast (1999) for a more detailed discussion of the logic of this prediction.

[7] Recently, Oyer (2007) tests a third firm-side prediction. A number of extensions of the basic tournament model predict that in a tournament-type setting firms will favor insiders versus outsiders in deciding upon promotions (see Malcomson (1984), Chan (1996), and Waldman (2003)). Oyer tests this prediction by looking at tenure decisions in economics departments. He finds results consistent with the prediction. Specifically, outside of the world's top-ten departments, those hired into tenured positions from the outside are more productive on average than those promoted from within. Note, however that this finding could also be explained by asymmetric learning as in Greenwald (1979,1986) and by the importance of influence activities as in Milgrom (1988) and Milgrom and Roberts (1988).

In a recent analysis, DeVaro (2006a,2006b) uses a structural-estimation approach to consider simultaneously both worker-effort and firm-side predictions of tournament theory. DeVaro looks at a sample of skilled workers taken from a cross-section of establishments in four metropolitan areas. Using a structural-estimation approach that treats promotions, wage spreads, and performance as endogenous variables, he finds support for both types of predictions. Specifically, he finds results consistent with firms choosing spreads optimally and workers providing more effort when spreads are larger.

3) Pros and Cons

There are clearly some strong positives associated with tournament theory. Probably the most important is the basic plausibility of the argument. Clearly, the possibility of promotion does serve as an important incentive for worker effort in real-world firms and it would be surprising if in thinking about promotion practices firms did not consider the ramifications for worker effort. Further, the approach provides a very plausible explanation for a well documented internal-labor-market finding. That is, a quite plausible explanation for large wage increases at promotion is that the large wage increases are used to provide incentives for effort.

The other main positive is that, as discussed in some detail above, most studies that have tested implications of the tournament approach have found supportive evidence. As discussed, there is substantial evidence that as the tournament model predicts worker effort is positively related to the spread in the compensation between winning and losing. Also, studies also generally find that compensation practices vary within and across firms in ways consistent with theoretical predictions. Specifically, evidence supports the prediction that the spread is a positive function of the number of lower level employees and also that there should be a convex relationship between compensation and job level.

The main disadvantage of the tournament approach is that the theory has not been developed in ways that make clear the extent to which the approach is capable of capturing various internal-labor-market findings such as early wage increases at one job level predicting

subsequent promotions, wage increases upon promotion being small relative to wage differences across adjacent levels, and serial correlation in promotion rates. But the fact such findings have not been addressed to date does not mean that some enriched tournament model is not capable of capturing these findings. Another drawback is that there are certain aspects of standard tournament theory that seem unrealistic. For example, the idea that firms commit to "prizes" that are independent of attributes and performance of the winner seems inconsistent with empirical evidence in papers such as Baker, Gibbs, and Holmstrom (1994a,b) where the wage paid to a newly promoted worker seems to depend both on worker attributes and performance. As discussed more below, possibly the answer is that there are labor-market tournaments but they take a somewhat different form than initially modeled by Lazear and Rosen.

C) Asymmetric Learning/Promotions as Signals

Another important approach for thinking about internal-labor-market wage and promotion
dynamics is the idea that promotions serve as signals as first modeled in Waldman (1984a) and later extended in Bernhardt (1995). This approach is capable of capturing a number of empirical findings in the internal-labor-market literature, but its inability to capture some of the key findings means that by itself it is unlikely to be the correct explanation for wage and promotion dynamics in internal labor markets.

1) Basic Description

Waldman (1984a) puts forth the basic argument. That paper considers a model characterized by asymmetric as opposed to symmetric learning. When workers enter the labor market their ability levels are initially unknown and there is learning as in the symmetric learning case. The difference is that only a worker's current employer directly observes ability

while other firms learn about worker ability by observing the actions of the current employer. In Waldman's analysis the key such action is the promotion decision.[8]

To be precise, Waldman considers a two-period setting in which workers vary in their innate ability levels but look identical when they enter the labor market. Firms are characterized by two jobs – a low-level job where the return to ability is low and a high-level job where this return is high. In the first period all workers are assigned to the low-level job and then at the end of the period a worker's initial employer learns the worker's innate ability level. In the second period high-ability workers are then promoted to the high-level job, where one of the key results is that fewer workers are promoted than is socially efficient. The logic is that a promotion serves as a signal that the worker's ability is high, so after a worker is promoted other firms are willing to bid more for the worker's services. This means the current employer must pay a promoted worker more to stop the worker from being bid away, but this, in turn, causes firms to only promote workers when they are significantly more productive in the high-level job.

Bernhardt (1995) extends this analysis. The main differences are that in Bernhardt's model workers are in the labor market for more than two periods, there is a richer process of human-capital accumulation, and Bernhardt allows workers to vary in terms of their publicly-observed schooling levels. What happens in Bernhardt's model is that as a cohort ages workers are promoted in bunches, where the highest ability workers are promoted first and then the next highest, etc. Further, as in Waldman's analysis, because of signaling, promotions are associated with large wage increases while the frequency with which workers are promoted is inefficiently low because firms try to avoid the large wage increases associated with promotion.

In addition to showing that the main results found in Waldman (1984a) continue to hold in a richer model, Bernhardt also derives a number of new and interesting findings. For example, Bernhardt finds that asymmetric learning results in firms favoring more highly educated workers in the promotion process. That is, holding fixed a worker's true productivity,

---

[8] Greenwald (1979,1986) is another early analysis of asymmetric learning in labor markets, but his focus was on the turnover decision rather than the promotion decision.

workers with more education are promoted first. This arises because even in the absence of a promotion workers with more education are paid a higher wage, so the signaling role of promotion is smaller for these workers. Bernhardt also shows how his model can explain serial correlation in promotion rates, i.e., promotion fast tracks.

2) Theoretical Extensions and Related Empirical Tests

There have been a number of theoretical extensions of this framework and a more limited number of empirical tests. I believe the most important of the theoretical extensions appears in Zabojnik and Bernhardt (2001).[9] That paper connects the promotion-as-signal idea to the idea of labor-market tournaments discussed earlier (see also Gibbs (1995) and Ghosh and Waldman (2006)). In the traditional labor-market-tournament model the firm imposes the promotion tournament in order to create incentives for workers to provide effort. In the Zabojnik and Bernhardt model the tournament instead arises endogenously from asymmetric information and the resulting signaling aspect of promotions. That is, rather than committing to a prize associated with promotion, prizes arise endogenously due to the positive signal associated with promotion and the resulting large wage increases needed to stop promoted workers from being bid away. In addition to showing how the labor-market-tournament approach and the promotion-as-signal approach can be reconciled, Zabojnik and Bernhardt show that their model can explain various findings in the firm-size-wage-effects literature and the interindustry-wage-differences literature.

On the empirical side there have been a number of tests of whether asymmetric learning is important in labor markets, but only one that directly looks at the promotion-as-signal hypothesis. The classic empirical test of asymmetric learning in labor markets is found in Gibbons and Katz (1991) which builds on Greenwald's (1979,1986) classic analysis of adverse selection in labor-market turnover. The Gibbons and Katz argument is that laid-off workers

---

[9] Other theoretical papers that focus on the promotion-as-signal hypothesis include Ricart i Costa (1988), Waldman (1990), Bernhardt and Scoones (1993), and Owan (2004).

should be lower ability on average than those fired in a plant closing because adverse selection means laid off workers are drawn from the low end of the ability distribution while workers fired in a plant closing are drawn from the whole distribution.[10] Based on this, they derive three testable implications: i) predisplacement wages should be uncorrelated with the cause of the displacement; ii) postdisplacement wages should be lower for laid-off workers than those fired in a plant closing; and iii) postdisplacement unemployment duration should be higher for laid-off workers than those fired in a plant closing. Gibbons and Katz test these predictions using data from the CPS and find evidence that supports all three predictions.

Although the Gibbons and Katz empirical analysis and closely related analyses that have followed provide strong evidence that asymmetric learning is important in labor markets, it is only indirect evidence for the promotion-as-signal hypothesis.[11] The only empirical analysis focused directly on the promotion-as-signal hypothesis is found in DeVaro and Waldman (2006) (see also Belzil and Bognanno (2004) for related results). Related to a result in Bernhardt (1995), that paper first extends the theory to show that the signaling aspect of promotions should be larger for workers of lower schooling levels because, even before promotion, workers with higher schooling levels are already thought of as higher ability. DeVaro and Waldman then show that this has implications for how wage increases due to promotions should vary with schooling and how the performance level required for promotion should vary with schooling. After deriving testable implications along this line they show supporting evidence using the same data set investigated in the Baker, Gibbs, and Holmstrom (1994a,1994b) study discussed earlier. They also consider various alternative explanations for their findings and argue that the promotion-as-signal hypothesis matches the evidence better than any of the alternatives.

---

[10] To be precise, the Gibbons and Katz argument allows for both adverse selection as in Greenwald's (1979,1986) analysis and for the possibility that layoffs serve as a signal like in the promotion-as-signal hypothesis.

[11] Doiron (1995) and Grund (1999) also find evidence consistent with the Gibbons and Katz predictions using data for Canada and Germany, respectively, while Acemoglu and Pischke (1998), which is discussed in more detail later, extends the Gibbons and Katz framework to consider incentives for firms to provide their workers with general human capital and then show supporting evidence using German data.

3) Pros and Cons

There are clearly some positives associated with the promotion-as-signal hypothesis. The main one is the basic plausibility of the hypothesis. Promotions are typically publicly observable events and workers, especially successful ones, provide their job-assignment history on their resume. This is consistent with the history of job assignments serving as important pieces of information for prospective employers which is exactly the promotion-as-signal argument. It is also plausible that large wage increases at promotion are due at least partly to signaling. That is, if a worker's job-assignment history is an important consideration for prospective employers, then it is plausible that when a worker's current employer improves that history via a promotion the employer also increases the worker's wage to stop the worker from being bid away.

The approach also has significant empirical support both in terms of various empirical studies and being able to explain some important findings in the empirical wage- and promotion-dynamics literature. First, Gibbons and Katz (1991) and related studies provide strong evidence that asymmetric learning is important in real-world labor markets. Second, the more direct test found in DeVaro and Waldman (2006) finds evidence consistent with the hypothesis. Third, the hypothesis is consistent with two important empirical findings concerning promotion processes, i.e., large wage increases upon promotion but wage increases upon promotion being small relative to wage differences across adjacent job levels.[12]

In addition to the positives discussed above, there are also some important negatives. Specifically, some of the important empirical findings concerning wage and promotion dynamics seem inconsistent with learning being purely asymmetric. Two stand out. First and most importantly, in a model of pure asymmetric learning a worker's salary increase in a period in which the worker is not promoted should be completely determined by observable characteristics

---

[12] The approach is consistent with wage increases upon promotion being small relative to wage differences across adjacent levels if workers accumulate general human capital as they age. The approach can also explain the empirical finding discussed earlier that wage increases upon promotion are positively related to the number of workers at the level from which the promoted worker is drawn. That is, this prediction is consistent with the promotion-as-signal hypothesis since the signaling value of a promotion should be positively related to the number of workers who were competing for the promotion.

such as schooling, labor-market experience, and firm tenure. But numerous studies such as Baker, Gibbs, and Holmstrom (1994a,1994b) make it clear that wage increases for non-promoted workers vary substantially and cannot be solely explained by observables. Second, the approach does not easily capture the finding that the size of wage increases early at a job level forecast speed of promotion. The reason is that in a standard-asymmetric-learning model a firm does not want to reveal positive information about a worker when there is no return in terms of productivity, so in periods in which a worker is not promoted the firm should not give higher wage increases to the higher productivity workers.[13]

D) <u>Symmetric Learning with Human-Capital Acquisition and Job Assignment</u>

The last approach I discuss is the symmetric learning approach to wage and promotion dynamics first explored in Gibbons and Waldman (1999b). That approach combines symmetric learning with two other standard building blocks concerning how internal labor markets operate – human-capital acquisition as in Becker (1962,1964) and job assignment as in Rosen (1982) and Waldman (1984b). This approach is the one most successful at capturing the wide variety of empirical findings concerning wage and promotion dynamics found in the internal-labor-market literature. But even this approach has some drawbacks concerning trying to match the evidence.

1) Basic Description

The Gibbons and Waldman framework is similar to Waldman's and Bernhardt's analyses discussed previously, except Gibbons and Waldman assume symmetric rather than asymmetric learning. As indicated, Gibbons and Waldman combine symmetric learning, human-capital accumulation, and job assignment. In their model all workers look identical when they enter the

---

[13] The above argument implicitly assumes workers with the same observable characteristics. If workers have different observable characteristics such as heterogenous schooling levels, then it is possible that a large wage increase early on due, for example, to higher schooling could predict speed of promotion if, as is plausibly the case, workers with higher schooling also on average get promoted more quickly. This could explain the Baker, Gibbs, and Holmstrom findings concerning wage increases early on predicting promotion since that test does not control for the schooling level. It would be easy to investigate this argument by seeing whether the empirical finding continues to hold even after schooling is controlled for.

labor market but actually they vary in terms of their innate abilities, where at the end of each period all firms observe a worker's output and update their beliefs concerning each worker's innate ability. As in Harris and Holmstrom (1982) discussed earlier, this learning is gradual because of a stochastic term in the production function. Another key assumption is that workers accumulate general human capital as they age with the result that "effective" ability grows over a worker's career although expected effective ability falls when the realization for output is very low. Also, there are three job levels which vary in terms of the extra productivity associated with effective ability, where the human-capital accumulation process means workers on average move up the job ladder as they age. Finally, wages are determined by spot-market contracting.

Gibbons and Waldman show that this framework captures most of the basic empirical findings concerning internal-labor-market wage and promotion dynamics discussed in Subsection II.A. For example, the model explains why real-wage decreases are not rare but demotions are. Real-wage decrease are not rare because the learning process means that a worker should receive a real-wage decrease when realized output is sufficiently low that expected effective ability falls, but this rarely translates into a demotion since a demotion also requires expected effective ability to cross a critical value at which productivity across the two jobs is the same. The model also explains large wage increases upon promotion since promoted workers on average are those with large increases in expected effective ability, and that large wage increases early at a job level predict quicker promotion. This follows given that a large wage increase early on means significant growth in expected effective ability and higher expected effective ability means that, on average, the worker will achieve the expected effective ability required for promotion more quickly. The model also explains serial correlation in wage increases, that wage increases at promotion are small relative to the differences between average wages across adjacent job levels, and is consistent with serial correlation in promotion rates.[14]

---

[14] Gibbons and Waldman show their framework exhibits serial correlation in promotion rates in their full-information benchmark analysis, although they are unable to show that it necessarily exhibits serial correlation in promotion rates under symmetric learning.

Gibbons and Waldman also show that this framework can explain many of the results concerning performance evaluations discussed in Subsection II.C given the additional assumption that supervisors evaluate individuals relative to other workers with the same labor-market experience. This part of their analysis builds on a discussion in Harris and Holmstrom (1982). For example, Medoff and Abraham (1980,1981) find that within a job wages are positively related to labor-market experience while performance evaluations are either unrelated or slightly negatively related to experience. In the Gibbons and Waldman framework, within a job wages are positively related to labor-market experience because general human capital increases with experience. But if workers are evaluated relative to others with the same labor-market experience, then performance evaluations within a job will fall with experience because workers with high expected innate ability are promoted out of the job as they age while those with low expected innate ability are promoted into the job. The framework also explains differences found between cross-sectional and longitudinal analyses of the same data set and why performance evaluations predict both future promotions and future wage increases.

2. Theoretical Extensions and Related Empirical Tests

Important theoretical extensions of this framework appear in Gibbons and Waldman (2006). That paper first addresses empirical findings concerning the role of schooling in wage and promotion dynamics (these are the findings discussed in Subsection II.B). Specifically, in this model workers vary in terms of their publicly observable schooling levels, where a higher schooling level means expected innate ability is higher. They show that this enrichment allows the model to capture the major empirical findings discussed in Subsection II.B. For example, the model provides an explanation for why higher schooling improves promotion probabilities. That is, higher schooling means higher starting levels of expected effective ability which, in turn, means expected effective ability on average grows faster and passes the critical value for expected effective ability required for promotion more quickly. The model also explains why schooling is positively related to the wage even after controlling for experience and job

assignment and why the returns to experience may be positively related to schooling, although remember the evidence on this issue is mixed.

In the second part of their 2006 paper Gibbons and Waldman address cohort effects (see also Gibbons and Waldman (2004)). Remember, cohort effects mean that, even after controlling for differences in the composition of the workers in a cohort, a cohort's average wage years after entry into a firm reflects to some degree the cohort's average starting wage. Their 1999 model is not consistent with this finding, but in their 2006 paper they show that the framework is consistent with cohort effects when task-specific human capital is incorporated. Task-specific human capital means that the human capital accumulated during a period of work is more valuable in later periods when the worker is on a job where the tasks are similar. Specifically, Gibbons and Waldman assume that a worker assigned to the high-level job when old is more productive when the worker was also assigned to the high-level job when young. They show that this enrichment allows their framework to capture the type of cohort effects found by Baker, Gibbs and Holmstrom (1994a,b) if, during boom periods, entering cohorts both earn higher wages and enter the firm on average at higher levels of the job ladder. This approach can also explain the economy-wide cohort effects and industry-level cohort effects found in recent papers such as Kahn (2006), Oyer (2006), and Oreopoulos, von Wachter, and Heisz (2006).

A number of recent studies empirically estimate the Gibbons and Waldman (1999) model using large data sets from other countries (US data sets do not typically contain information on job level, so other country's data sets that include this type of information are needed to test this model). One such study is Lluis (2005). She uses longitudinal data from the German Socio-Economic Panel and generalized method of moments techniques. Her results are generally supportive of the framework, although the evidence that learning helps determine job assignment is weak. In particular, she finds some evidence consistent with learning being important in job assignment for younger workers, but the evidence for older workers is weak.[15] She hypothesizes

---

[15] Lima and Pereira (2003) is a related study that employs Portugese data. They find a result similar to this result of Lluis. That is, one focus of that paper is what factors drive the wage premia associated with promotion, where they

that the weak evidence for learning may be due to the apprenticeship system in Germany because much of the learning about worker ability may occur during the apprentice period. But an alternative explanation, as discussed next, is that her findings are in fact what a more complete analysis of the Gibbons and Waldman framework would predict.

3. Pros and Cons

The pros here are straightforward. The theoretical analyses show that the approach is capable of explaining a very wide set of the empirical findings in the internal-labor-market wage and promotion dynamics literature. These include what I have referred to as basic empirical findings, findings concerning the role of performance evaluations, and findings concerning the role of schooling. Also, incorporating task-specific human capital, which seems to be a realistic enrichment, allows the model to explain cohort effects which is an empirical phenomenon that has gained significant empirical support recently.

On the negative side there are two related issues. First, Gibbons and Waldman do not focus much on the idea that given symmetric learning, at least under their assumption that innate ability is a fixed attribute of the worker, most learning should occur early in careers. This is potentially problematic if empirical findings for older workers can only be explained by assuming learning is significant. Second, as discussed above, a number of the empirical investigations of the Gibbons and Waldman framework find evidence for symmetric learning only for younger workers.

As a final point, it is unclear to me how significant these issues are. In their 1999 paper Gibbons and Waldman show that many of the empirical findings in the literature can be explained in their framework under the assumption of full information. It is thus possible the two issues discussed above are not problems for their framework at all. As stated above, in a

---

find that towards the bottom of the job ladder learning is an important factor behind these wage premia while at the top learning is unimportant. Hunnes (2006) uses Norwegian data and an empirical methodology similar to that employed by Lluis (2005). Hunnes finds stronger evidence for learning, but in his analysis the strongest evidence appears at the top levels of the hierarchy. See also Dias da Silva and van der Klaauw (2006).

world of fixed innate worker attributes, learning should be mostly confined to the early part of workers' careers. So possibly the correct perspective is that the Gibbons and Waldman framework provides the right explanation for the main empirical findings in Section II, where at low values of labor-market experience it is their symmetric-learning arguments that apply while at high levels their full-information arguments apply. Further theoretical and empirical work exploring this possibility would be helpful.

E) Overview and Synthesis

Among the candidate models considered (which I chose because I believed they were the models with the most empirical support), clearly the framework that combines symmetric learning, human-capital accumulation, and job assignment is the one the literature currently suggests is best able to explain empirical findings concerning internal-labor-market wage and promotion dynamics. Of course, it is possible this is the case because the other frameworks have not been developed in ways that make clear the extent to which these other frameworks have the ability to explain the empirical evidence. But I believe this is unlikely. The more plausible interpretation is that symmetric learning, human-capital accumulation, and job assignment are all important elements in the operation of real-world internal labor markets.

But I also believe careful study of the evidence does not support the idea that the basic model investigated in Gibbons and Waldman (1999) is sufficient for explaining the evidence. Rather, various enrichments of the model seem important. First, both because of its real-world plausibility and because of the growing evidence supporting cohort effects, incorporating task-specific human capital as in Gibbons and Waldman (2006) seems important. Second, the evidence in favor of asymmetric learning such as Gibbons and Katz (1991) along with recent direct evidence in favor of the promotion-as-signal hypothesis suggests that an element of asymmetric learning also needs to be incorporated. In other words, most current models assume learning is either purely symmetric or purely asymmetric, but in fact there is no reason that real-world learning cannot be a mix of the two. And my sense is that the evidence supports this.

Also, incentives associated with promotion must also be important. But it is unclear whether it is best to incorporate the type of exogenous tournament explored by Lazear and Rosen (1981), or whether, along the lines of Zabojnik and Bernhardt's (2001) analysis, endogenous tournaments based on the promotion-as-signal hypothses are more realistic. The difference concerns whether the firm commits to optimal values for future high wages associated with promotions or whether these future high wages arise endogenously as the result of signaling. Future empirical work focused on distinguishing between these possibilities would be of interest.

The evidence also suggests that the Gibbons and Waldman assumption of spot contracting is not fully accurate. Many empirical findings point to the "market" being important in wage determination, so a spot-contracting assumption will typically give better predictions and explanations than a model in which workers are completely insulated from the demand for their

services in the aggregate labor market.[16] But there are aspects of the evidence such as nominal wage rigidity, the type of cohort effects found by Beaudry and DiNardo, and Green Card effects that constrain the salaries of those at the high end of a job's salary range that suggest that wages do deviate from the market wage in important ways (see Gibbs and Hendricks (2004) for a related empirical analysis and discussion). It is an open question whether these types of deviations can be incorporated into the theoretical modeling other than in an ad hoc fashion.

As a final point, there are a few subjects that deserve more attention both at the theoretical and empirical levels. One such subject is the connection between internal-labor-market wage and promotion dynamics and the turnover decision. How a worker's career progresses during his or stay at a single employer should be closely related to both voluntary and involuntary turnover decisions and also how the worker performs at the new job. On the empirical side there are a few papers that develop evidence along these lines. For example, Baker, Gibbs, and Holmstrom (1994a,1994b) has a number of results concerning entry and exit

---

[16] See Lazear and Oyer (2004) for a recent analysis that shows that, even in a highly regulated market like Sweden's, the evidence indicates that the market is important in wage determination.

rates at different levels and also some comparisons of wage growth and promotion outcomes for new entrants versus incumbents, while Treble et al. (2001) provides a similar empirical analysis. But more empirical investigation of this issue would be helpful. Similarly, there is limited theoretical work connecting internal-labor-market wage and promotion practices with turnover outcomes and, especially if the empirical literature matures to the point that the facts are clear, more theoretical attention to the topic could prove to be very fruitful.[17]

Another subject that deserves more attention is bonus payments. Most of the empirical research in this literature focuses on salaries rather than bonuses. This is probably because salary data is frequently more readily available and because some of the early empirical work in this literature focused on salaries and ignored bonuses. But there is work such as Lin (2005) which includes evidence concerning bonuses and the findings suggest bonuses work quite differently than salaries. For example, Lin finds that bonuses vary more with aggregate economic conditions than do salaries and also that within a level bonuses vary more than do salaries. These type of results suggest that salary and bonus play somewhat different roles in compensating workers and thus that further empirical and theoretical work on this issue could be fruitful.[18]

IV. EMPIRICAL EVIDENCE ON HUMAN-RESOURCE PRACTICES

An important topic in the study of internal labor markets is the type of human-resource practices firms employ in order to increase the productivity and effectiveness of their workers. And in particular, much of the recent literature on this topic has focused on "traditional" versus "innovative" human-resource practices. In this section I focus on the empirical literature on the subject, while Section V discusses the theoretical literature and Section VI discusses international differences concerning internal labor markets most of which can be connected to

---

[17] Recent theoretical work that starts to move in this direction includes Munasinghe (2005), Ghosh (2007), and Ricchetti (2007).

[18] See Ricchetti (2007) for an interesting recent empirical and theoretical investigation focused on how bonuses vary across hierarchical levels.

differences in human-resource practices (see Ichniowski, Shaw, and Prennushi (2003) for an earlier survey that covers the material found in this section in more depth).

A) The Basics

The literature on human-resource practices makes a distinction between what are referred to as traditional practices and innovative practices. Traditional practices refer to practices that were predominant in the US prior to the 1980s while innovative practices have become more common recently. Traditional practices are less focused on ensuring that a firm's workers are high skilled, that incentives for superior performance are high, and that information sharing is high. These practices include hourly pay or salary compensation where there is little connection between pay and performance, narrowly defined jobs and no job rotation, limited screening for other than managerial employees, no work teams or quality circles, little formal on-the-job training, and the use of layoffs when product demand declines.

In contrast, innovative practices are focused more on recruiting and developing workers with high skills, eliciting high performance, and sharing of information. These practices include the use of problem-solving teams and quality circles, job rotation, more effort and resources put into worker screening during the recruitment process, more on-the-job training, more use of incentive pay that can take various forms, and higher job security. As discussed in more detail in the next section where the theoretical literature is discussed, these practices seem to constitute a set of complementary or interlocking parts where a main goal is a transformation of how decisions are made in the organization. That is, one of the goals of the employment of these practices is a shift in decision making away from the managers towards production workers.

As discussed in Cole (2000), these practices first emerged among a limited set of large Japanese manufacturers in the 1960s and then became widespread among large Japanese manufacturers in the late 1960s and 1970s. These practices served to improve the quality performance of these large Japanese manufacturers and in order to successfully compete US firms began to adopt these practices starting in the 1980s. A number of studies such as Osterman

(1994,2000), Lawler, Mohrman, and Ledford (1995), and Cappelli and Neumark (2001) document the adoption of these practices in US firms and, in particular, show rapid growth in adoption during the 1980s and 1990s.[19] As an example, Lawler, Mohrman, and Ledford find that the use of problem-solving teams almost doubled among large US firms between 1987 and 1993.

In terms of understanding the time-series evidence, it is also useful to consider in greater detail what led over time to the increased employment of these practices. First, survey evidence like that found in Osterman (2000) shows that early adopters tended not to revert back over time to the use of more traditional practices. Also, a significant part of the growth in the use of these practices was due to a higher proportion of firms employing these practices over time. But this is not the sole source of the growth. Rather, there is also clear evidence that firms that employ innovative practices tend to employ larger numbers later periods (see again Osterman (2000)).

B) Different Types of Evidence

Before discussing the effects on firm performance of the adoption of innovative practices, let me briefly discuss the different types of evidence that have been brought to bear on the issue. There are a number of different approaches. Early studies that looked at the impact of innovative-human-resource practices tended to be case studies typically of a single firm or a small set of firms. Well known studies that take this approach include Krafcik (1988) and Wilms (1995) that look at a single auto assembly plant, Berg et al. (1996) that focus on apparel manufacturing, and Ichniowski (1992) that looks at paper manufacturing.

Although these types of studies certainly provide valuable evidence, they can also be limited in that inferences are drawn from observations concerning a small number of firms or factories within firms. And in such a study there is the possibility that effects being found are not in fact due to the adoption of innovative work practices, but rather to some other difference

---

[19] See also Ichniowski, Delaney, and Lewin (1989), Black and Lynch (1996,2004), and Gittleman, Horrigan, and Joyce (1998).

that is correlated with the employment of innovative practices. For example, maybe innovative practices tend to be employed on average by higher quality managers and it is these managers rather than the practices per se that are responsible for the higher productivity frequently associated with innovative practices. This type of scenario provides an alternative explanation for Krafcik's and Wilms' findings in their classic studies of the NUMMI auto assembly plant.[20]

In order to avoid some of the shortcomings of the standard case-study approach, a number of recent papers employ what has come to be called "insider econometrics" (see Ichiowski and Shaw (2007) for a detailed description of this approach). This approach combines the best aspects of the case-study methodology with the positive aspects of systematic statistical analysis. In this approach researchers first do the equivalent of a case study to understand the nature of the production process and the data needed to test well-formulated hypotheses. Then, after collecting the required data, state-of-the-art statistical techniques are employed to investigate which of various hypotheses are supported by the data. This approach provides the highest quality evidence in this area, so much of the discussion that follows focuses on these studies.

Within the insider-econometrics approach, there are two distinct sets of papers. One set focuses on single firms while the other looks at multiple factories and firms within the same industry. Examples of the former include Lazear's (2000) study of piece rates on the productivity of workers installing windshields, Nagin et al.'s (2002) study of piece-rate pay and call center productivity, and Hamilton, Nickerson, and Owan's (2003) study of teams in apparel production (see also Knez and Simester (2001), Bartel (2004), and Freeman and Kleiner (2005)). Examples of the latter include Dunlop and Weil's (1996) analysis of module versus bundle production in the apparel industry, Ichniowski, Shaw, and Prennushi's (1997) study of various innovative work practices in steel production, and Boning, Ichniowski, and Shaw's (2007)

---

[20] In that case a plant shut down by General Motors was reopened as a joint venture by GM and Toyota using many of the same workers but Toyota management. Upon reopening innovative work practices were introduced and productivity improved. But a case study approach cannot easily answer the extent to which the improved productivity was due to the innovative practices versus other changes associated with the new management.

follow-up study of steel production (see also MacDuffie (1995), MacDuffie and Pil (1996), and Kelley (1996)).

A final set of studies are those that conduct nationwide cross-industry surveys of businesses concerning their human-resource practices. These studies are useful for documenting the prevalence of innovative human-resource practices within a country at a date in time, but are somewhat limited in terms of understanding the details of what drives the employment of these practices and the impact of these practices. Examples of such studies focused on the US include Huselid and Becker (1996), Black and Lynch (2001,2004), and Cappelli and Neumark (2001), while studies focused on other countries include Greenan and Guellec (1997) on France, Michic and Sheehan (1999) on Great Britain, and Eriksson (2003) on Denmark.

C) Basic Effects of the Adoption of Innovative Work Practices

The extensive empirical investigation of the adoption of innovative-human-resource practices makes clear that in most cases adoption of such practices increases productivity. Of course, this is not surprising. It is unlikely the employment of these practices would become increasingly more common over time unless there was a return associated with their use. In terms of understanding which theories explain the returns and growing use of these practices, however, what is needed is more detailed evidence concerning the nature of these returns and more detail concerning patterns of adoption.

One finding is that the increased productivity associated with the use of innovative work practices is not always solely due to the increased productivity of an existing workforce, but can also be partly due to upgrading of the workforce. For example, Lazear (2000) investigated worker productivity and firm profitability at the Safelite Glass Corporation after the firm moved from hourly pay to piece-rate pay. Consistent with standard economic theory of incentive pay, worker productivity of the existing workforce rose. But this only accounted for about half of the overall rise in productivity at the firm. The other half was the result of an improved ability in recruitment to attract highly productive workers and possibly fewer exits of the most productive

workers. A second related example is found in Hamilton, Nickerson, and Owan's (2003) analysis of an apparel factory. In their analysis a move from individual piece rates to team production and team-based incentive pay raised productivity substantially, where in fact the high productivity workers, i.e., those most likely to be hurt monetarily by moving away from individual piece rates, were the first to voluntarily join the newly forming teams.

The next finding concerns the details concerning the manner in which innovative practices help the productivity of an existing workforce. Not surprisingly, there is clear evidence that adopting a larger number of innovative practices increases productivity more than adopting one or a few practices. This is not surprising since, if this were not the case, it would be hard to understand why firms that employ innovative practices seem on average to employ larger numbers as time passes. What is of more interest is the substantial evidence indicating that the productivity increase associated with employing a bundle of innovative practices is not simply the sum of increases associated with each practice individually. Rather, the productivity increase associated with employing a bundle of practices frequently significantly exceeds this sum.

A study that nicely captures this idea is the classic study of steel production found in Ichniowski, Shaw, and Prennushi (1997). That paper employs a panel data set that covers almost all of the finishing lines in integrated steel mills in the US. For these lines they consider 26 different human-resource-management practices which they then translate into four systems of practices – a system that employs mostly traditional practices, a system that employs mostly innovative practices, and two intermediate systems. One intermediate system employs innovative practices focused mostly on communication and information sharing while the other adds teamwork and formal training. A main finding is that, comparing across these four systems, the more innovative practices employed the higher on average was worker productivity. In fact, the system that employed a full set of innovative practices raised productivity on average more than twice the amount of the system associated with the next highest number of innovative practices. Further, the introduction of any single practice had a statistically insignificant effect

on productivity. So the conclusion is that innovative work practices improve productivity, but in addition there seem to be strong complementarities.

A number of other studies have also found or argued for important complementarities. For example, Knez and Simester (2001) study the introduction by Continental Airlines of an employee bonus based on firm-wide performance, where contrary to the standard free-riding argument Knez and Simester find evidence consistent with this firm-wide performance bonus improving productivity. They argue (and present anecdotal evidence consistent with their argument) that the use of teams or work groups at the firm increased the extent of mutual monitoring which is what allowed the firm-wide bonus to be successful. Similarly, in their paper on apparel manufacturing, Hamilton, Nickerson, and Owan suggest that it was the simultaneous introduction of module production and group-incentive pay that allowed the introduction of teamwork to significantly increase productivity.

In addition to the effects on productivity, there is also a question of how the introduction of innovative work practices affects other important outcome variables, in particular, output quality and firm profitability (an increase in productivity does not necessarily translate into increased profits since innovative work practices can also translate into increased costs). As was the case for productivity, there is strong evidence that introducing innovative practices positively affects output quality. This has been found in various studies including MacDuffie (1995), Ichniowski, Shaw, and Prennushi (1997), and Boning, Ichniowski, and Shaw (2007). The evidence for a positive profit impact is a bit weaker but at least in some cases one can infer that profits were also positively affected. For example, in their analysis of steel finishing lines Ichniowki, Shaw, and Prennushi estimate a significant profit increase for the lines that employed the full set of innovative practices. Of course, the fact that these innovative practices have not been universally adopted suggests that the profitability of these practices might vary across different settings. I turn to this issue now.

D) Further Effects and Patterns of Adoption

In addition to detailed evidence concerning the effects of adopting innovative work practices, evidence has also developed concerning patterns of adoption. As discussed earlier, in the US innovative practices started to be adoped in the early 1980s and there has been substantial growth since then both in the number of firms employing these practices and the number of practices the average such firm employs. But this diffusion has not been random. One clear pattern concerning adoption is that innovative practices are much more common in new factories and factories that have reopened under new management (see, for example, Kochan, Katz, and McKersie (1986), Ichniowsi and Shaw (1995), and Ichniowki, Shaw, and Prennushi (1997)).

There are three possible explanations for this finding. First, there may be transition costs associated with having an operating factory move from using traditional work practices to using innovative practices. Since the first firms to adopt innovative practices should be those where the profitability of adoption is highest, if transition costs are significant then at any point in time adoption should be higher at new factories and reopened factories. Second, there may be an agency problem. It is possible that innovative work practices are profitable everywhere but, if a manager has little experience in managing a factory which employs innovative practices, it may not be in the manager's best interests to have the switch occur (because, for example, it makes him or her more easily substituted with a manager who has such experience). Third, it is possible that not all managers are sufficiently familiar with the productivity advantages associated with innovative practices and it is the managers at new factories and newly reopened factories that, on average, are more likely to know about these advantages.[21]

A second factor that is important in explaining who adopts innovative work practices is the complexity of the production process, where here the evidence is clearer that the reason is that the profitability of adoption is higher for more complex production processes. For example,

---

[21] One piece of evidence consistent with the first possibility is found in Ichniowki and Shaw (1995). They find that the introduction of new managers who, on average, might be more open to change does not have a statistically significant effect on the likelihood that a production line or factory changes from traditional to innovative practices. On the other hand, Lynch (2007) has recently found results consistent with the third possibility. That is, she finds that employers who are best situated to learn about new practices are more likely to adopt innovative practices.

Boning, Ichniowski and Shaw (2007) find that adoption rates for innovative practices are higher and the profitability of adoption is higher for production lines that make more complex shapes. Similarly, Dunlop and Weil (1996) find that innovative work practices – in particular, what they refer to as module production – are employed by apparel manufacturers that produce smaller batches and employ quicker turnaround. This is not surprising since many innovative practices concern increased communication and improved problem solving by production workers and such practices quite plausibly have higher returns when production is more complex.

A final related finding is that the adoption of innovative practices is more likely and more profitable when the production process employs new computer-aided information technologies. Findings along this line appear numerous studies including Milgrom and Roberts (1990), Dunlop and Weil (1996), and Bresnahan, Brynjolfsson, and Hitt (2002). The obvious interpretation of this finding is that it is a specific example of the earlier point that innovative work practices are more valuable and thus more likely to be adopted when production processes are more complex.

V. THEORETICAL MODELS CONCERNING HUMAN-RESOURCE PRACTICES

This section discusses various theoretical models that have been put forth to explain the use of innovative-human-resource practices. Much of the discussion focuses on the issue of complementary work practices, but I also discuss models that do not rely on complementarity.

A) Complementary Practices

The main theoretical approach for modeling the role of innovative-human-resource practices is to assume the practices are complementary. Complementary activities refer to activities such that "if the levels of any of the subset of activities are increased, then the marginal return to increases in any or all of the remaining activities rises" (Milgrom and Roberts (1990), p. 514). The idea that innovative work practices are complementary immediately explains why innovative practices are frequently employed in bundles and that the marginal return to adopting innovative practices can be increasing (over a range) in the number of practices adopted. For an

example of the latter, complementary practices can explain Ichniowski, Shaw, and Prennushi's (1997) finding that the work system containing the highest number of innovative practices was associated with an increase in productivity more than double the increase associated with the work system associated with the next largest number of innovative practices.

An example of this type of argument is Milgrom and Roberts' (1995) analysis of Lincoln Electric. The Lincoln Electric case is a classic example of a firm characterized by innovative work practices. Three of the practices employed by Lincoln Electric are as follows. First, Lincoln made heavy use of piece rates. All production workers and many non-production workers at the firm had their compensation at least partly determined by piece rates. Second, initially accomplished through direct stock purchases and later through an ESOP, a large proportion of the firm's stock was held by the firm's employees. Third, there was a high degree of job security accomplished through a no-layoff policy.

Milgrom and Roberts (1995) provide an explanation for these three practices using the idea of complementarity. It is well known that piece rates improve worker incentives, but there is the downside known as the "ratchet effect," i.e., if outputs are too high then the firm learns the rate is too high and lowers the rate for subsequent periods. In turn, if this is anticipated by workers, then the positive incentive effects of the piece rate are reduced.[22] Milgrom and Roberts argue that Lincoln was able to avoid this problem through the high level of employee stock ownership. The idea is that high employee stock ownership reduces the incentive for the firm to lower piece rates and in this way transfer rents from workers to the firm. Finally, since layoffs are a way to reduce employee stock ownership, the no-layoff policy was used as a way to commit to a high level of employee stock ownership for future periods.[23]

B) Four Additional Arguments Concening Complementarities

---

[22] Theoretical analyses concerning the ratchet effect appear in Lazear (1986), Gibbons (1987), and Carmichael and MacLeod (2000).

[23] Baker, Gibbons, and Murphy (1994) discuss another complementarity in Lincoln's practices which is a complementarity between Lincoln's use of piece rates and its use of bonuses.

The argument in Milgrom and Roberts (1995) concerning Lincoln Electric is just one example of theoretical arguments that have been put forth that describe how specific innovative work practices can be complementary. In this subsection I describe four other important arguments of this type.

The first argument concerns the use of group-based incentive plans. As discussed in Alchian and Demsetz (1972), the free-rider problem suggests that individual piece rates should be superior to group-based incentive plans. But possibly because of the difficulty of measuring individual output, many firms employ group-based incentive plans rather than individual piece rates for a significant proportion of the workforce. The argument is then that there are a number of other innovative work practices employed because they support the use of group-based incentive plans. For example, Kandel and Lazear (1992) argue that firms may spend resources on activities like indoctrination and the formation of quality circles to establish and enforce group norms that ameliorate the free-rider problem through peer pressure (see also the related discussion in Kreps (1990) concerning corporate culture). Also, because highly productive workers might not want to join a firm where incentives are tied to group rather than individual output, another innovative practice potentially complementary to group-based incentive plans is additional effort and resources spent on worker recruitment.[24]

A second argument focuses on the decentralization of decision making. Many firms that have adopted innovative work practices employ practices like group-based decision-making teams and quality circles that move decision making from managers to lower level employees. This second argument is that various other innovative work practices are employed because they support this decentralization. For example, if lower level employees make decisions, then it is important that these employees are cooperative, highly skilled, and provide high effort.

---

[24] The empirical analysis in Hamilton, Nickerson, and Owan (2003) discussed earlier throws some doubt on this particular theory of innovative work practices. As discussed, in that analysis the firm was able to increase productivity by moving to a group-based incentive plan from individual piece rates. This should not happen if, as argued above, group-based incentive plans are only used when individual piece rates are not feasible. Also inconsistent with the above argument, Hamilton, Nickerson, and Owan found that it was the high-productivity workers who on average were the first to voluntarily join the newly forming teams.

Cooperation can be achieved by group-based incentive plans consistent with the argument of Holmstrom and Milgrom (1991) discussed in more detail below, higher skills can be achieved by higher levels of on-the-job training as in the argument of Aoki (1986), while high effort is also a consequence of group-based incentive plans. Also, because new ideas can lead to the elimination of jobs, it is also important as argued by Aoki (1988) that firms offer high levels of employee security. Along the same line Carmichael and MacLeod (1993), argue that practices like job rotation can add to the range of jobs to which a worker is assigned and this can help a firm commit to high levels of job security.

The third argument is that of Holmstrom and Milgrom (1991,1994) concerning the need to balance incentives in a multitasking world. A standard problem in the theory of multitasking is that incentive pay which is based on measurable output inefficiently distorts effort away from important tasks where the value to the firm is not measureable. In particular, Holmstrom and Milgrom (1994) translate this into an argument concerning complementarity. Specifically, if the firm provides high incentive pay associated with measured performance, then it is important that the firm also employ practices that limit the resulting distortions. Holmstrom and Milgrom argue that one way firms can do this is to couple high incentive pay with worker ownership of assets since, for example, ownership will cause workers to provide more effort and resources into maintaining the asset. They also argue that, due to complementarity, high incentive pay should be coupled with more discretion on the part of workers concerning what the job entails.

In addition to a theoretical analysis, in their 1994 paper Holmstrom and Milgrom argue that their framework matches empirical evidence found in a number of studies. Their theoretical approach predicts that high incentive pay, asset ownership by employees, and worker discretion should all covary positively. For example, a change in an exogenous parameter that increases the return to using high incentive pay should increase the degree to which high incentive pay is used, but because of complementarity should also increase employee asset ownership and worker discretion. This prediction is supported by empirical findings in Anderson and Schmittlein (1984) and Anderson (1985) concerning the choice between in-house sales agents and

independent sales agents in industrial selling. They find covariation of just the type predicted. That is, independent sales agents had higher incentive pay, more discretion, and at least in one important dimension higher asset ownership. Further, the variables predicting the choice between in-house and independent sales agents were also consistent with the theoretical predictions. Holmstrom and Milgrom also relate their theoretical predictions to findings in a number of other studies including Shepard (1993) and Slade (1996) concerning gas stations and Brickley and Dark (1987) and Krueger (1991) concerning fast food.

The final argument is Aghion and Tirole's (1997) theory of real versus formal authority. One of their main results is that in choosing whether to use centralized or decentralized decision making firms face a trade-off between incentives and agency costs. On the one hand, decentralization increases incentives for workers to acquire information. On the other, there is an agency cost because the interests of the employees and the firm are not typically perfectly aligned. In turn, this logic results in decentralization through practices such as problem-solving teams and quality circles to be complementary with increased use of incentive pay. The argument is that higher incentive pay serves to ameliorate the agency-problem associated with decentralization by aligning workers' interests with those of the firm.[25]

C) Other Theoretical Models

This subsection discusses theoretical models concerning innovative work practices that do not focus on complementarities. Rotember (1994) focuses on altruism in the workplace, where he argues that in the presence of altruism group-based compensation can increase worker productivity. The argument is straightforward. Given group-based compensation and altruism, each worker increases his or her effort level because the worker internalizes to some extent the effects added effort has on other workers' compensation. Rotember also argues that it can be profitable for a firm to induce altruism in this type of setting by allowing time for socialization

---

[25] Acemoglu et al. (2006) in a recent paper extends the theory to produce testable implications and then provides supporting evidence using both French and British data from the 1990s.

and other related behaviors. Overall, Rotemberg's argument is a quite plausible additional mechanism to Kandel and Lazear's peer-pressure argument for how the free-rider problem can be avoided in firms characterized by group-based compensation.

Ortega (2001) provides a new explanation for job rotation. Rather than focusing on benefits job rotation may have in developing an employee's human capital, Ortega argues that the returns to job rotation are mostly in terms of firm learning. In Ortega's model the firm is initially uncertain about the productivity of its various workers at each worker's various potential job assignments, while there is also uncertainly concerning the potential profitability of these various jobs. He shows that in this setting job rotation is superior to job specialization in terms of how much the firm learns along these two dimensions.[26] Hence, job rotation should be employed when the returns in terms of learning are high and costs are low.

In addition to presenting the theory, Ortega argues that this theory is a good match for empirical evidence concerning job rotation. He focuses on two pieces of evidence. First, as found by Campion, Cheraskin, and Stevens (1994), the use of job rotation is negatively related to a worker's value for firm tenure. Second, as found by Gittleman, Horrigan, and Joyce (1998), the use of job rotation is positively related to whether the firm is using a new technology. Ortega argues that each of these findings is consistent with his theory. First, high tenure means that the firm already has a lot of information about the worker so the additional information that can be gathered through job rotation is of little value. Second, new technology means job rotation is valuable because the firm has little information about its current jobs.[27]

Zabojnik (2002) focuses on centralization versus decentralization. In particular, this paper considers a setting similar to that considered by Aghion and Tirole (1997) discussed

---

[26] Ortega (2001) builds on Meyer (1994) which also looks at the effect that job assignment can have on the rate firms learn about workers' abilities but which does not specifically focus on job rotation.

[27] Ortega also argues that the human-capital explanation for job rotation is inconsistent with the evidence. But this seems less clear cut to me. In terms of the human-capital theory, it is possible that what is valuable is a little bit of experience on a number of jobs. In turn, this version of the human-capital theory is consistent with the evidence in that high tenure means the worker likely already has at least a little experience on a number of jobs so additional job rotation is not needed, while new technology means workers do not have the needed experience with the firm's current jobs so additional job rotation is very valuable.

above. The main point is that a firm may decentralize decision making through practices like problem-solving teams even when managers are better informed than production workers. The reason is that it can be cheaper to induce workers to provide high effort when the project or method of production chosen is that favored by the workers rather than the one favored by the manager. In other words, to the extent workers provide higher effort when they believe the project or method of production has a higher likelihood of succeeding, the firm may be able to increase productivity by letting the workers decide even when the manager is better informed.[28]

The last paper I consider in this subsection is Akerlof and Kranton (2005). They take the perspective common in sociology and psychology that norms matter. In particular, how an employee behaves in a particular situation such as how much effort a worker expends depends on the situation and the worker's identity, where identity refers to the worker's social category (such as man or woman, black or white, etc.) and the worker's self-image. The basic idea is that a worker who identifies with the firm or work group will, monetary incentives held fixed, choose higher effort than will a worker who does not identify with the firm or relevant work group.

This perspective can explain the employment of a number of innovative work practices. The basic idea is that, because a worker provides higher effort when he or she identifies with the firm or work group, the firm has an incentive to adopt practices that serve to foster this type of identification. So, for example, it might be worthwhile for a firm to adopt high levels of screening during the recruitment process because screening can be used to ensure that new employees are of a type conducive to identifying with the firm or work group. Or similarly, the formation of work groups may be beneficial because workers more easily identify with a work group than with the firm itself. One problem with this argument, however, is that Akerlof and Kranton argue that identification is a substitute for monetary incentives. To the extent this is the case, then we should expect the practices just mentioned not to be used in conjunction with high levels of incentive pay which is exactly the opposite of what the evidence suggests. But possibly

---

[28] Zabojnik shows this logic is only correct when workers face liquidity constraints which make it costly for firms to induce high worker effort strictly through contracting.

the Akerlof and Kranton discussion of this issue is incomplete in the sense that maybe certain types of incentive pay can be used to help establish identification, which in turn could explain why these practices are used together.

D) <u>Overview</u>

The evidence seems quite clear cut that complementarity is important for understanding the move towards innovative work practices. There are a number of aspects of the evidence that point in this direction. First, innovative work practices are frequently adopted in bundles. Second, there is evidence of an increasing marginal return in terms of productivity of adopting additional practices. Third, the evidence suggests the return to adopting a single practice is either small or possibly even zero. Each of these findings is consistent with the basic idea of complementarity which is that the return to adopting any specific practice is positively related to the number of other practices adopted.

So the most difficult question is, of the various theories concerning complementarity that have been proposed, which one or ones seem most promising as an explanation for the evidence? I think this is a question where the literature is far from giving a conclusive answer. But I think some tentative conclusions can be drawn. First, a number of the theories put forth have some support in the data, so my sense is that the right answer is not that there is a single theory that is correct and the others have no explanatory power. Rather, it is likely the case that a number of the theories are important for understanding real-world organizations.

For example, as discussed, Holmstrom and Milgrom's theory concerning balancing incentives in a multi-tasking world seems consistent with various studies concerning sales agents. And similarly, as mentioned in footnote 24, Aghion and Tirole's theory of real versus formal authority stands up well in a recent direct test of the theory. There is some question concerning whether one of the basic premises of the free-riding argument is correct. That is, given the popularity of group-based incentive plans and the findings in Hamilton, Nickerson, and Owan (2003) concerning the returns of moving from individual piece rates to group-based

incentive plans, it is questionable whether group-based incentive plans are used primarily when individual piece rates are not feasible (see footnote 23 for a brief discussion). On the other hand, there are other parts of that argument that seem quite plausible. That is, for whatever reasons group-based incentive plans are adopted, it seems quite plausible that activities used to enforce high-effort norms are employed as a way of avoiding the potential free-rider problem.

Second, to the extent one of the theories is the correct explanation for the bulk of the evidence, my vote is on the argument that focuses on moving decision making from managers to lower level employees. On the one hand, this argument ties together the largest number of innovative practices. Specifically, group-based decision making teams and quality circles are explained as practices that directly serve to decentralize decision making, while various other practices such as group-based incentive plans, high levels of on-the-job training, job rotation, and high levels of job security are employed as ways to support the decentralized decision making. On the other hand, detailed empirical analysis such as Ichniowski, Shaw, and Prennushi (1997) suggests that it is the extensive use of group-based decision making, i.e., decentralization, that is central for the increased productivity associated with innovative work practices.[29]

VI. INTERNATIONAL DIFFERENCES

There is a companion literature to the one discussed in the previous two sections which concerns international differences concerning how internal labor markets operate, where this literature is closely related to the earlier one in that many of the differences can be thought of as differences in human-resource practices. In this section I discuss the literature on international differences and, in particular, one focus is trying to understand what can be learned by thinking

---

[29] In comparison to production lines that employ traditional work practices, Ichniowki, Shaw, and Prennushi find that productivity rises 6.7 percent for lines that employ a full set of innovative work practicies and 3.2 percent for lines that emphasize high teamwork and communications. In contrast, productivity on average is only 1.4 percent higher for lines that emphasize communications with less stress on teamwork.

about the two literatures together. Note that since most of the literature on international

differences is focused on US-Japanese differences, that will be the focus here also.[30]

A) US-Japanese Differences

In this subsection I describe the major differences that have been identified concerning

the operation of US and Japanese internal labor markets. In terms of a later discussion where I

relate this literature to the literature discussed in the previous two sections that focuses on the

growing use (mostly in the US) of innovative-human-resource practices, there are two points

worth emphasizing. First, many of these differences are closely related to differences in

innovative- and traditional-human-resource practices discussed previously. Second, much of the

evidence showing large differences in the the operation of US and Japanese internal labor

markets is from studies that are now decades old. In a later subsection I come back to this point.

I start by describing the US-Japanese differences in internal-labor-market operation that

are closely related to differences between traditional- and innovative-human-resource practices.

First, a number of studies such as Kagono et al. (1985) and Lincoln, Hanada, and McBride

(1986) find that decisions are made at lower levels of the hierarchy in Japanese firms than at US

firms (see also the earlier work of Clark (1979) and Cole (1979)). For example, Lincoln,

Hanada, and McBride conducted a study of 55 US firms and 51 Japanese firms in terms of the

hierarchical level at which decisions were made. They found that in the Japanese firms decisions

were made at lower hierarchical levels on average than in the US firms. This finding is similar

to the earlier discussion of innovative work practices wherein a number of innovative practices

serve to move decision making away from managers and to lower level employees.

Second, there is substantial evidence that Japanese firms offer more on-the-job training

and correspondingly Japanese employees have higher levels of firm-specific human capital (see,

for example, Hashimoto (1994), MacDuffie and Kochan (1995), and Aoki and Okuno-Fujiwara

---

[30] I would especially like to thank Hodaka Morita for suggestions and discussions that were helpful in my
formulating the discussion in this section.

(1996)). Further, much of this literature focuses on higher levels of multi-skilling in Japanese firms, where multi-skilling refers to acquiring the human capital needed to do multiple jobs which occurs, for example, with heavy use of job rotation. Studies that discuss the prevalence of multi-skilling in Japanese firms include Koike (1977,1988), Dertouzos, Lester, and Solow (1989), and Ito (1992). Note that higher levels of on-the-job training and job rotation were also part of the discussion concerning innovative-human-resource practices.

Third, Japanese firms are characterized by higher levels of continuous process improvement. For example, in Japanese firms, through group-decision making teams and quality circles, lower level employees are more frequently solicited for suggestions concerning improvements in the production process (see Koike (1988) for a discussion). Also, Dertouzos, Lester, and Solow (1989) found that in steel production in the late 1980s in Japanese factories engineers were located in a manner that allowed for quicker responses to day-to-day operational problems than was the case in US steel production.

Fourth, long-term employment is higher and turnover rates are lower in Japanese firms. This has been found by numerous authors including Hashimoto and Raisian (1985), Mincer and Higuchi (1988), Blinder and Krueger (1996), and Kato (2001). For example, Hashimoto and Raisian compared US and Japanese labor markets by analyzing data from the Special Labor Force Report for the US and the Basic Survey of Employment for Japan. They found that long-term job retention rates were higher in Japan and that average job tenure was also higher. These ideas that long-term employment is higher and turnover is lower in Japanese firms are similar to the emphasis on job security in firms that employ innovative work practices.

The last two differences do not have a close relationship with the discussion of traditional and innovative work practices. Fifth, as discussed, for example, in Holzhausen (2000), in Japanese firms promotion to managerial ranks occurs later in careers and correspondingly there is little differentiation in terms of wage and promotion rates for white-collar workers early in careers. More specifically in terms of the latter point, in large Japanese firm early in careers workers with the same educational background are treated similarly in terms of wages, wage

growth, and promotion rates, but after approximately 10 to 15 years of experience wage growth and promotion decisions depend more heavily on performance evaluations. Of further interest, although outcomes do not vary much early in careers, the evidence suggests that many young white-collar workers in Japan do have a clear sense of their long-term career prospects.

Sixth, within-firm income dispersion is smaller in Japan. For example, Koike (1988) compares wage differentials between managers and average white-collar workers in Japan and various European countries and finds that Japan has one of the smallest wage differentials. Since it is typically believed that within-firm income dispersion is higher in the US than in Europe, this clearly suggests much higher within-firm income dispersion in Japan than in the US.

B) Candidate Models for Explaining US-Japanese Differences

A number of the theoretical approaches for explaining US-Japanese differences in internal-labor-market operation rely on models characterized by multiple equilibria. One set of models focus on the connection between adverse selection and turnover. The best known of these papers is Acemoglu and Pischke (1998) which builds on Greenwald (1979,1986) and Gibbons and Katz (1991) (other studies that take an adverse selection/turnover approach for explaining US-Japanese differences include Prendergast (1989) and Chang and Wang (1995)).[31]

Acemoglu and Pischke consider a labor-market setting in which a worker's current employer knows more about a worker's ability than do prospective employers, so turnover is reduced due to the resulting adverse-selection problem. What is new here is the focus on on-the-job training. The adverse-selection problem means that a worker's current employer has monopsony power after the training period. This monopsony power gives the firm an incentive to offer and pay for general training of its workers (while at the same time reducing a worker's incentive to pay for general training). Based on this logic, Acemoglu and Pischke identify the possibility of multiple equilibria. In what might be called the Japanese equilibrium, the adverse-

---

[31] Katz and Ziderman (1990) and Chang and Wang (1996) also consider similar models but do not relate their analyses to US-Japanese differences.

selection problem is severe causing little turnover and high monopsony power which, in turn, results in high on-the-job training. In what might be called the US equilibrium, the adverse-selection problem is mild so turnover is higher, monopsony power is lower, and the result is a lower level of on-the-job training. In addition to developing the theoretical argument, Acemoglu and Pischke present evidence using data on German apprentices that supports the theory.

A second argument appears in Prendergast (1992). Prendergast focuses on delayed promotion in the Japanese case and higher firm-specific human capital. In Prendergast's model each employer has private information about each of its young worker's long-term career prospects and the firm must decide whether to reveal this information to workers which would increase incentives for workers with high potential. In the US equilibrium firms promote young workers with high potential which signals potential and results in high incentives. In the Japanese equilibrium, instead, the return to training low-ability young workers is high and firms choose to retain high incentives for low-ability workers by not promoting young workers and in this way not revealing private information. One problem with this argument is that, as mentioned above, even though there are no promotions early in careers in Japan, many young white-collar workers in Japan do seem to have a clear sense of long-term career prospects.[32]

Morita (2001,2005) also presents a multiple-equilibrium argument, where his argument serves as an explanation for differences concerning human-capital accumulation including multi-skilling, decentralized decision making, continuous process improvement, and turnover. His argument builds on earlier discussions in Aoki (1986) and Koike (1988) and is related to the argument concerning decentralization in Subsection V.B. Basically, Morita identifies a set of complementarities across these variables that leads to the possibility of multiple equilibria. When workers are multi-skilled they have the knowledge required to make better decisions, so

---

[32] A related empirical result is found in Umezaki (2001) which shows a strong correlation in Japan between task assignments when young and subsequent promotion outcomes. In other words, if young workers in Japan with better long-term career prospects are assigned different tasks, then in contrast to Prendergast's argument, even in the absence of any differentiation when workers are young concerning wage and promotion outcomes, young workers should be able to infer their long-term prospects.

decentralized decision making becomes more attractive. In turn, the combination of multi-skilling and decentralized decision making makes continuous process improvement feasible, where over time the high levels of continuous process improvement mean that each firm is characterized by high levels of firm-specific human capital. Finally, the high levels of firm-specific human capital reduce turnover and increase average job duration.

In Morita's argument continous process improvement is more beneficial when workers have high levels of firm tenure, so the return to adopting continuous process improvement is positively related to the number of other firms that adopt it. That is, when other firms adopt continuous process improvement they are less likely to raid other firms' employees because skills are not transferable, so job durations are higher which means any single firm has a higher incentive to adopt continuous process improvement. The result is there can be two equilibria. In the Japanese equilibrium all firms adopt continuous process improvement which lowers the turnover rate and makes this choice profitable. On the other hand, in the US equilibrium firms do not adopt continuous process improvement which raises the turnover rate and makes choosing continuous process improvement unprofitable. Morita argues that historical events during World War II can explain the different equilibrium choices across the two countries.

The last theoretical argument I discuss is the one found in Owan (2004) which employs the promotion-as-signal hypothesis. There are two key assumptions in Owan's model. First, in addition to varying in terms of ability, a firm's workers also vary in the quality of worker-firm matches. Second, a worker's current employer privately learns the worker's ability before learning the quality of the worker-firm match. Given these assumptions, Owan shows that depending on various factors such as the distribution of worker characteristics and the relative value of firm-specific human capital across jobs, one of two possible equilibria will arise. In an early-promotion equilibrium high ability workers are promoted after the firm learns ability but before learning the quality of worker-firm matches, while in a late-promotion equilibrium there are no promotions until the firm learns both ability and the quality of worker-firm matches.

The main point of Owan's analysis is that the differences between these two potential equilibria match well with the differences in US-Japanese internal-labor-market operations discussed above. Think of the late-promotion equilibrium as the Japanese equilibrium and the early-promotion equilibrium as the US equilibrium. First, clearly the late-promotion equilibrium matches that promotions occur later in careers in Japan and that there is less differentiation in wage and promotion outcomes early in careers in Japan. Second, Owan shows that the late-promotion equilibrium has no turnover because the lack of early promotions serving as a signal causes adverse selection to be severe and the secondary market for workers to shut down, while in the early-promotion equilibrium high ability workers with bad matches leave their initial employers. So the late-promotion equilibrium matches more long-term employment and less turnover in the Japanese case. Third, the lack of promotion signaling in the late-promotion equilibrium means that the asymmetry of information is more severe in this equilibrium which results in less income dispersion. This means the late-promotion equilibrium also matches the smaller level of income dispersion in the Japanese case.[33] Finally, in addition to showing these results, Owan provides a discussion for why Japan seems to be characterized by the late-promotion equilibrium and the US the early-promotion equilibrium, where like Morita's similar discussion part of Owan's discussion focuses on historical events.

C) <u>Convergence</u>

As is made clear above, much of the literature on US-Japanese differences was based on data or observations from decades ago. This is potentially important. From the discussion in Section IV we know that innovative work practices were introduced in Japan prior to being introduced in the US and after the introduction in the US there was and likely continues to be slow diffusion of these practices. This suggests that, at least for the differences discussed above that are related to differences between traditional- and innovative-human-resource practices, the

---

[33] Owan (1999) shows how a related model also explains why in Japan there are higher levels of firm-specific human capital.

differences are much smaller today than they were in the past. Another way to put this is that a number of studies such as Osterman (1994,2000) and Cappelli and Neumark (2001) show that there has been significant growth over time in the employment of innovative-human-resource practices in the US while there is no similar empirical literature suggesting decreases over time in the use of innovative work practices in Japan. Hence, at least for the differences discussed above that are related to differences between traditional and innovative work practices, these differences are likely much smaller today than they were say 20 or 30 years ago.

The idea that some of the differences today are much smaller than they were in the past introduces an interesting possibility concerning what drives these differences. That is, it is likely that, at least for differences related to differences concerning traditional- and innovative-human-resource practices, it was the later introduction of innovative work practices in the US and their slow diffustion that was a main driving force for many of the large differences observed between the US and Japan in the 1980s and 1990s. As time passed and diffusion continued differences became smaller, and possibly substantially smaller. Note that I am not claiming here that there is nothing to explain once one takes into account the later introduction of innovative work practices in the US and slow diffustion. Rather, I am arguing that any full picture of what drives differences between the US and Japanese labor markets needs to take these ideas into account.

The other issue that this perspective suggests is the relative weight one should put onto the various international differences that have been identified concerning the US and Japan. As innovative work practices have diffused in the US, a number of the differences that are related to innovative practices have very likely gotten smaller. But for a couple of the differences there is little evidence suggesting convergence. Specifically, in terms of later promotion in Japan and less differentiation in wage and promotion outcomes early on, lower income dispersion in Japan, and possibly lower turnover, I see little evidence for convergence. So possibly future empirical work might focus on whether it is correct that convergence has been important for some differences but not for others, while future theoretical work might focus more on the differences which seem to be subject to less convergence.

D) <u>Overview</u>

Since many of the differences between US and Japanese internal-labor-market operations are related to differences between traditional and innovative-human-resource practices in the US setting, there should be a close linkage between theories used to explain the movement from traditional towards innovative work practices in the US and theories used to explain differences between US and Japanese internal-labor-market operations. Another way to put this is that, if part of what is driving the differences between US and Japanese internal-labor-market operations is that innovative work practices are more commonly used in Japan than in the US, then the arguments for what is happening in the US over time and the arguments concerning US-Japanese differences need to be tightly linked.

The above discussion concerning convergence is consistent with this idea. It attributes at least some of the difference between US and Japanese internal-labor-market operations, and possibly much early on, to the later introduction of innovative work practices in the US and slow diffusion. This is consistent with the discussion in Section IV which gave a prominent role to slow diffusion of innovative work practices in understanding the trends in the use of innovative work practices in the US setting. In following up this idea, it might be of interest to compare current US and Japanese internal-labor-market operations, but only consider US firms which have adopted innovative work practices. This would provide a sense of how much of the US-Japanese differences in internal-labor-market operations is due to slow diffusion and how much is due to differences that remain even after US firms adopt innovative work practices (see Ichniowski and Shaw (1999) for a related analysis).

In addition, to the extent that there are remaining differences even after taking into account the slow diffusion which my guess is that there are, the question that remains is what drives these remaining differences? Of the theories that I have reviewed, the one that I believe shows the most promise is the one presented in Morita (2001,2005). On the one hand, for various reasons, the other arguments are somewhat lacking in terms of providing a convincing

explanation for the gamut of US-Japanese differences. Prendergast's (1992) model relies on young Japanese workers not knowing their career prospects which seems inconsistent with the evidence, while Owan's (2004) model although interesting relies on an ad hoc assumption concerning job-match information being revealed later to firms than information about worker abilities.[34] Also, although there is empirical support for Acemoglu and Pischke's (1998) argument, the argument does not explain very many of the differences. On the other hand, Morita's argument explains a large number of differences, while it is also heavily focused on information sharing and decentralized decision making which are central in most descriptions of the differences between the US and Japanese settings.

But even Morita's argument has the drawback that it does not explain one of the key US-Japanese differences which is early promotion and early differentiation in the US setting and late promotion and late differentiation in the Japanese case. Possibly, one could extend Morita's argument to capture this important difference by focusing on how different levels of firm-specific human capital affects whether equilibrium is characterized by early or late promotions. But this is a possibility that can only be resolved with further theoretical research on the topic.[35]

Finally, although the discussion in this section focuses on differences between US and Japanese internal-labor-market operations because that is the focus of most of the literature, much of the discussion likely also applies to comparisons of Japanese internal labor markets with those found in many other industrialized countries. That is, it is not just the case that innovative-human-resource practices spread from Japan to the US and then slowly diffused in the US, but rather this later adoption and slow diffusion is also true of many other industrialized economies.

---

[34] I do find other aspects of Owan's argument appealing, so maybe much of what Owan argues is correct but there is a different explanation for why Japan is characterized by late promotions and the US early promotions.

[35] My idea here is related to Harris and Holmstrom's (1982) argument discussed in Section III. Firms would like to partially insure workers against uncertainty concerning true innate ability and one way to potentially do this is to employ late promotions and little differentiation early in careers. This strategy is feasible in the Japanese case because the high levels of firm-specific human capital mean that a worker who is revealed to be of high innate ability early on cannot be hired away by another firm. But in the US case, because of the lower levels of firm-specific human capital, this strategy is infeasible because a young worker who is revealed to be of high innate ability who is not promoted or given a high wage would be bid away.

So, to the extent that many of the differences between the operation of US and Japanese internal labor markets discussed above are due to differences in the employment of innovative-human-resource practices across the two countries, it would be natural to expect similar differences in internal-labor-market operations between Japan and other industrialized countries.[36]

VII. CONCLUSION

The literature on internal labor markets has matured to the point that for a number of branches of the literarure there is now a very healthy two-way interaction between theory and empirical work. On the one hand, numerous theoretical papers try to provide explanations for empirical phenomena and, more specifically, for patterns found in the data. On the other, numerous empirical papers try to test the most promising theories. In turn, combining theoretical and empirical contributions has the potential to advance our understanding of various issues in internal labor markets in important ways.

In this survey I focus on this two-way interaction between theory and empirical work. In particular, I focused on two topics in the extensive literature on internal labor markets in order to both show the benefits of a rich interaction between theory and evidence and to draw some conclusions in each case concerning which theoretical approaches look most promising. The first topic I considered is wage and promotion dynamics in internal labor markets. Various distinct theoretical approaches have been put forth concerning this topic. After reviewing the various theories and the relevant empirical literature, my conclusion is that a model that combines symmetric learning, human capital accumulation, and job assignment as in Gibbons and Waldman (1999,2006) has the most promise for explaining the various empirical findings. But other theoretical approaches such as tournament theory and asymmetric learning also seem important for a full understanding of what drives wage and promotion dynamics inside firms.

---

[36] One exception may be between Japan and Germany. Dertouzos, Lester, and Solow (1989) argue that even early on the operation of West Germany's internal labor markets had similarities to those found in Japan that was not seen in most other industrialized countries.

The second literature I focused on is the literature concerning the growing use by firms of innovative work practices. After reviewing the empirical and theoretical literatures, the clear conclusion is that, as argued by numerous authors including Milgrom and Roberts (1990,1995) and Holmstrom and Milgrom (1994), complementarity is a driving force for understanding the growing use of these practices. The evidence is less clear concerning which of the various theories that have been put forth to explain the nature of these complementarities is most important. But the argument that the driving force is a desire to move decision making from managers to lower level employees seems to be the argument that best matches the evidence.

I also considered the literature on international differences concerning internal labor markets, where most of this literature focuses on US-Japanese differences. One of the conclusions here is that at least some of the historical difference between the US and Japan likely stems from the later initial adoption of these practices in the US and slow diffusion. However, some differences likely still remain even after taking account of the later initial adoption in the US and slow diffusion, and my sense is that the correct explanation for the remaining differences lies with different incentives for decentralized decision making across the two countries as emphasized, for example, recently by Morita (2001,2005) and earlier by Aoki (1986).

I hope to have shown how a close partnership between theory and empirical evidence can be used to reach a deeper understanding of the driving forces behind internal-labor-market phenomena than can be reached by either empirical evidence or theory taken in isolation. Hopefully, future work concerning wage and promotion dynamics and the use of innovative-human-resource practices, as well as research on other internal-labor-market topics, will continue to pursue the close two-way interaction between theory and empirical evidence described above.

REFERENCES

Abowd, J. and D. Card (1989), "On the Covariance Structure of Earnings and Hours Changes," *Econometrica*, 57, pp. 411-445.

Acemoglu, D., P. Aghion, C. LeLarge, J. Van Reenen, and F. Zilibotti (2006), "Technology, Information and the Decentralization of the Firm," Mimeo, MIT.

Acemoglu, D. and J. Pischke (1998), "Why Do Firms Train: Theory and Evidence," *Quarterly Journal of Economics*, 113, pp. 79-119.

Aghion, P. and J. Tirole (1997), "Formal and Real Authority in Organizations," *Journal of Political Economy*, 105, pp. 1-29.

Akerlof, G.A. and R. Kranton (2005), "Identity and the Economics of Organizations," *Journal of Economic Perspectives*, 19, pp. 9-32.

Alchian, A. and H. Demsetz (1972), "Production, Information Costs, and Economic Organization," *American Economic Review*, 62, pp. 777-795.

Anderson, E. (1985), "The Salesperson as Outside Agent or Employee: A Transaction Cost Analysis," *Marketing Science*, 4, pp. 234-254.

Anderson, E. and D. Schmittlein (1984), "Integration of the Sales Force: An Empirical Examination," *Rand Journal of Economics*, 15, pp. 385-395.

Aoki, M. (1986), "Horizontal vs. Vertical Information Structure of the Firm," *American Economic Review*, 76, pp. 971-983.

Aoki, M. (1988), *Information, Incentives, and Bargaining in the Japanese Economy* (Cambridge University Press: Cambridge, MA).

Aoki, M. and M. Okuno-Fujiwara (1996), *Keizai Shisutemu no Hikakuseido Bunseki (Comparative Institutional Analysis)* (Tokyo University Press: Tokyo).

Audas, R., T. Barmby, and J. Treble (2004), "Luck, Effort, and Reward in an Organizational Hierarchy," *Journal of Labor Economics*, 22, pp. 379-396.

Baker, G., R. Gibbons, and K. Murphy (1994), "Subjective Performance Measures in Optimal Incentive Contracts," *Quarterly Journal of Economics*, 109, pp. 1125-1156.

Baker, G., M. Gibbs, and B. Holmstrom (1994a), "The Internal Economics of the Firm: Evidence from Personnel Data," *Quarterly Journal of Economics*, 109, pp. 881-919.

Baker, G., M. Gibbs, and B. Holmstrom (1994b), "Investment in Human Capital: A Theoretical Analysis," *Journal of Political Economy*, 70, pp. 9-49.

Baker, M. (1997), "Growth-Rate Heterogeneity and the Covariance Structure of Life-Cycle Earnings," *Journal of Labor Economics*, 15, pp. 338-375.

Bartel, A. (2004), "Human Resource Management and Organizational Performance: Evidence from Retail Banking," *Industrial and Labor Relations Review*, 57, pp. 181-203.

Beaudry, P. and J. DiNardo (1991), "The Effects of Implicit Contracts on the Movement of Wages over the Business Cycle: Evidence from Microdata," *Journal of Political   Economy*, 99, pp. 665-688.

Becker, B. and M. Huselid (1992), "The Incentive Effects of Tournament Compensation Systems," *Administrative Science Quarterly*, 37, pp. 336-350.

Becker, G. (1962), "Investment in Human Capital: A Theoretical Analysis," *Journal of Political Economy*, 70, pp. 9-49.

Becker, G. (1964), *Human Capital* (NBER: New York).

Becker, G. and G. Stigler (1974), "Law Enforcement, Malfeasance and Compensation of Enforcers," *Journal of Legal Studies*, 3, pp. 1-18.

Belzil, C. and M.L. Bognanno (2004), "The Promotion Dynamics of American Executives," IZA Discussion Paper No. 1003.

Berg, P., E. Appelbaum, J. Bailey, and A. Kalleberg (1996), "The Performance Effects of Modular Production in the Apparel Industry," *Industrial Relations*, 35, pp. 356-373.

Bernhardt, D. (1995), "Strategic Promotion and Compensation," *Review of Economic Studies*, 62, pp. 315-339.

Black, S. and L. Lynch (1996), "Human Capital Investments and Productivity," *American Economic Review*, 86, pp. 263-267.

Black, S. and L. Lynch (2001), "How to Compete: The Impact of Workplace Practices and Information Technology on Productivity," *Review of Economics and Statistics*, 83, pp. 434-445.

Black, S. and L. Lynch (2004), "What's Driving the New Economy? The Benefits of Workplace Innovation," *The Economic Journal*, 114, pp. 97-116.

Blinder, A. and A. Krueger (1996), "Labor Turnover in the USA and Japan: A Tale of Two Countries," *Pacific Economic Review*, 1, pp. 27-57.
Bognanno, M.L. (2001), "Corporate Tournaments," *Journal of Labor Economics*, 19, pp. 290-315.

Boning, B., C. Ichniowski, and K. Shaw (2007), "Opportunity Counts: Teams and the Effectiveness of Production Incentives," *Journal of Labor Economics*, Forthcoming.

Bresnahan, T., E. Brynjolfsson, and L. Hitt (2002), "Information Technology, Work Organization and the Demand for Skilled Labor: Firm-Level Evidence," *Quarterly Journal of Economics*, 166, pp. 339-376.

Brickley, J.A. and F.H. Dark (1987), "The Choice of Organization Form: The Case of Franchising," *Journal of Financial Economics*, 18, pp. 401-420.

Calvo, G. (1979), "Quasi-Walrasian Theories of Unemployment," *American Economic Review*, 69, pp. 102-107.

Calvo, G. (1985), "The Inefficiency of Unemployment: The Supervision Perspective," *Quarterly Journal of Economics*, 100, pp. 373-387.

Campion, M., L. Cheraskin, and M. Stevens (1994), "Career-Related Antecedents and the Outcomes of Job Rotation," *Academy Management Journal*, 37, pp. 1518-1542.

Cappelli, P. and D. Neumark (2001), "Do 'High Performance' Work Practices Improve Establishment-Level Outcomes?," *Industrial and Labor Relations Review*, 54, pp. 737-775.

Card, D. (1999), "The Causal Effect of Education on Earnings," in O. Ashenfelter and D. Card, eds., *Handbook of Labor Economics, Vol. 3* (North-Holland: Amsterdam, The Netherlands), pp. 1801-1863.

Card, D. and D. Hyslop (1997), "Does Inflation 'Grease the Wheels of the Labor Market'?," in C. Romer and D. Romer, eds., *Reducing Inflation: Motivation and Strategy* (University of Chicago Press: Chicago, IL), pp. 71-114.

Carmichael, H.L. and W.B. MacLeod (1993), "Multiskilling, Technical Change and the Japanese Firm," *Economic Journal*, 103, pp. 142-160.

Carmichael, H.L. and W.B. MacLeod (2000), "Worker Cooperation and the Ratchet Effect," *Journal of Labor Economics*, 18, pp. 1-19.

Chan, W. (1996), "External Recruitment Versus Internal Promotion," *Journal of Labor Economics*, 14, pp. 555-570.

Chang, C. and Y. Wang (1995), "A Framework for Understanding Differences in Labor Turnover and Human Capital Investment," *Journal of Economic Behavior and Organization*, 28, pp. 91-105.

Chang, C. and Y. Wang (1996), "Human Capital Investment Under Asymmetric Information: The Pigovian Conjecture Revisited," *Journal of Labor Economics*, 14, pp. 505-519.

Chiappori, P.A., B. Salanie, and J. Valentin (1999), "Insurance, Learning, and Career Profiles: An Empirical Test," *Journal of Political Economy*, 107, pp. 731-760.

Clark, R. (1979), *The Japanese Company* (Yale University Press: New Haven, CT).

Cole, R.E. (1979), *Work, Mobility, and Participation* (University of California Press: Berkeley, CA).

Cole, R.E. (2000), "Market Pressures and Institutional Forces," in R.E. Cole and W. Richard Scott, eds., *The Quality Movement and Organization Theory* (Sage Publications: Thousand Oaks, CA), pp. 67-88.

Dertouzos, M.L., R.K. Lester, and R.M. Solow (1989), *Made in America* (MIT Press: Cambridge, MA).

DeVaro, J. (2006a), "Strategic Promotion Tournaments and Worker Performance," *Strategic Management Journal*, 27, pp. 721-740.

DeVaro, J. (2006b), "Internal Promotion Competition in Firms," *Rand Journal of Economics*, 37, pp. 521-542.

DeVaro, J. and M. Waldman (2006), "The Signaling Role of Promotions: Further Theory and Empirical Evidence," Mimeo, Cornell University.

Dias, da Silva and B. van der Klaauw (2006), "Wage Dynamics and Promotions Inside and Between Firms," IZA Discussion Paper No. 2351.

Doeringer, P. and M. Piore (1971), *Internal Labor Markets and Manpower Analysis* (Heath Lexington Books, Lexington, MA).

Dohmen, T.J., B. Kriechel, and G.A. Pfann (2004), "Monkey Bars and Ladders: The Importance of Lateral and Vertical Job Mobility in Internal Labor Market Careers," *Journal of Population Economics*, 17, pp. 193-228.

Doiron, D. (1995), "Layoffs as Signals: The Canadian Evidence," *Canadian Journal of Economics*, 28, pp. 899-913.

Dunlop, J. and D. Weil (1996), "Diffusion and Performance of Modular Production in the U.S. Apparel Industry," *Industrial Relations*, 35, pp. 334-354.

Ehrenberg, R.G. and M.L. Bognanno (1990a), "Do Tournaments Have Incentive Effects?," *Journal of Political Economy*, 98, pp. 1307-1324.

Ehrenberg, R.G. and M.L. Bognanno (1990b), "The Incentive Effects of Tournaments Revisited: Evidence from the European PGA Tour," *Industrial and Labor Relations Review*, 43, pp. 74S-88S.

Eriksson, T. (1999), "Executive Compensation and Tournament Theory," *Journal of Labor Economics*, 17, pp. 262-280.

Eriksson, T. (2003), "The Effects of New Work Practices – Evidence from Employer-Employee Data," in T. Kato and J. Pliskin, eds., *Determinants of the Incidence and the Effects of Participatory Organizations: Advances in the Economic Analysis of Participatory and Labor-Managed Firms* (Elsevier: Amsterdam, The Netherlands), pp. 3-30.

Farber, H.S. and R. Gibbons (1996), "Learning and Wage Dynamics," *Quarterly Journal of Economics*, 111, pp. 1007-1047.

Freeman, R. and M. Kleiner (2005), "The Last American Shoe Manufacturer: Decreasing Productivity and Increasing Profits in the Shift from Piece Rates to Continuous Flow Production," *Industrial Relations*, 44, pp. 307-330.

Freeman, S. (1977), "Wage Trends as Performance Displays Productive Potential: A Model and Application to Academic Early Retirement," *Bell Journal of Economics*, 8, pp. 419-443.

Garicano, L. (2000), "Hierarchies and the Organization of Knowledge in Production," *Journal of Political Economy*, 108, pp. 874-904.

Garicano, L. and T.N. Hubbard (2005), "Managerial Leverage is Limited by the Extent of the Market: Hierarchies, Specialization, and the Utilization of Lawyers' Human Capital," *Journal of Law and Economics*, 50, pp. 1-43.

Garicano, L. and E. Rossi-Hansberg (2006), "Organization and Inequality in a Knowledge Economy," *Quarterly Journal of Economics*, 121, pp. 1383-1435.

Ghosh, S. (2007), "Job Mobility and Careers in Firms," *Labour Economics*, 14, pp. 603-621.

Ghosh, S. and M. Waldman (2006), "Standard Promotion Practices Versus Up-or-Out Contracts," SSRN Johnson School Research Paper Series #20-06.

Gibbons, R. (1987), "Piece-Rate Incentive Schemes," *Journal of Labor Economics*, 5, pp. 413-429.

Gibbons, R. (1997), "Incentives in Organizations," *Journal of Economic Perspectives*, 4, pp. 115-132.

Gibbons, R. and L. Katz (1991), "Layoffs and Lemons," *Journal of Labor Economics*, 9, pp. 351-380.

Gibbons, R. and M. Waldman (1999a), "Careers in Organizations: Theory and Evidence," in O. Ashenfelter and D. Card, eds., *Handbook of Labor Economics, Volume 3*, (North- Holland: Amsterdam, The Netherlands), pp. 2373-2437.

Gibbons, R. and M. Waldman (1999b), "A Theory of Wage and Promotion Dynamics Inside Firms," *Quarterly Journal of Economics*, 114, pp. 1321-1358.

Gibbons, R. and M. Waldman (2004), "Task-Specific Human Capital," *American Economic Review*, 94, pp. 203-207.

Gibbons, R. and M. Waldman (2006), "Enriching a Theory of Wage and Promotion Dynamics Inside Firms," *Journal of Labor Economics*, 24, pp. 59-107.

Gibbs, M. (1995), "Incentive Compensation in a Corporate Hierarchy," *Journal of Accounting and Economics*, 19, pp. 247-277.

Gibbs, M. and W. E. Hendricks (2004), "Do Formal Salary Systems Really Matter?," *Industrial and Labor Relations Review*, 58, pp. 71-93.

Gittleman, M., M. Horrigan, and M. Joyce (1998), "Flexible Workplace Practices: Evidence from a Nationally Representative Survey," *Industrial and Labor Relations Review*, 52, pp. 99-115.

Green, J.R. and N. Stokey (1983), "A Comparison of Tournaments and Contracts," *Journal of Political Economy*, 91, pp. 349-364.

Greenan, N. and D. Guellec (1997), "Firm Organization, Technology and Performance: An Empirical Study," *Economics of Innovation and New Technology*, 6, pp. 313-347.

Greenwald, B. (1979), *Adverse Selection in the Labor Market* (Garland Press: New York).

Greenwald, B. (1986), "Adverse Selection in the Labour Market," *Review of Economic Studies*, 53, pp. 325-347.

Grund, C. (1999), "Stigma Effects of Layoffs? Evidence from German Micro-Data," *Economics Letters*, 64, pp. 241-247.

Habermalz, S. (2006), "More Detail on the Pattern of Returns to Educational Signals," *Southern Economic Journal*, 73, pp. 125-135.

Hamilton, B.H., J.A. Nickerson, and H. Owan (2003), "Team Incentives and Worker Heterogeneity: An Empirical Analysis of the Impact of Teams on Productivity and Participation," *Journal of Political Economy*, 111, pp. 464-497.

Harris, M. and B. Holmstrom (1982), "A Theory of Wage Dynamics," *Review of Economic Studies*, 49, pp. 315-333.

Hashimoto, M. (1994), "Employment-Based Training in Japanese Firms in Japan and the United States: Experiences of Automobile Manufacturers," in Lisa M. Lynch, ed., *Training and the Private Sector* (University of Chicago Press: Chicago, IL), pp. 109-148.

Hashimoto, M. and J. Raisian (1985), "Employment Tenure and Earnings Profiles in Japan and the United States," *American Economic Review*, 75, pp. 721-735.

Hause, J. (1980), "The Fine Structure of Earning and the On-the-Job Training Hypothesis," *Econometrica*, 48, pp. 1013-1030.

Holmstrom, B. (1979), "Moral Hazard and Observability," *Bell Journal of Economics*, 9, pp. 74-91.

Holmstrom, B. (1982), "Moral Hazard in Teams," *Bell Journal of Economics*, 13, pp. 324-340.

Holmstrom, B. and P. Milgrom (1991), "Multi-task Principal-Agent Analyses: Incentive Contracts, Asset Ownership and Job Design," *Journal of Law, Economics and Organization*, 7, pp. 24-52.

Holmstrom, B. and P. Milgrom (1994), "The Firm as an Incentive System," *American Economic Review*, 84, pp. 972-991.

Holzhausen, A. (2000), "Japanese Employment Practices in Transition: Promotion Policy and Compensation Systems in the 1990s," *Social Science Japan Journal*, 3, pp. 221-235.

Hunnes, A. (2006), "Testing the Role of Comparative Advantage and Learning in Wage and Promotion Dynamics," Mimeo, Norwegian School of Economics and Business Administration.

Huselid, M.A. and B.E. Becker (1996), "Methodological Issues in Cross-Sectional and Panel Estimates of the Human Resource-Firm Performance Link," *Industrial Relations*, 35, pp. 400-422.

Ichniowski, C. (1992), "Human Resource Practices and Productive Labor-Management Relations," in D. Lewin, O. Mitchell, and P. Scherer, eds., *Research Frontiers in Industrial Relations and Human Resources* (IRRA: Madison, WI), pp. 239-271.

Ichniowski, C., J.J. Delaney, and D. Lewin (1989), "The New Human Resource Management in US Workplaces: Is It Really New and Is It Only Nonunion?," *Relations Industrielles*, 44, pp. 97-119.

Ichniowski, C. and K. Shaw (1995), "Old Dogs and New Tricks: Determinants of the Adoption of Productivity-Enhancing Work Practices," *Brookings Papers on Economic Activity, Microeconomics*, pp. 1-65.

Ichniowki, C. and K. Shaw (1999), "The Effects of Human Resource Management Systems on Economic Performance: An International Comparison of U.S. and Japanese Plants," *Management Science*, 45, pp. 704-721.

Ichniowki, C. and K. Shaw (2003), "Beyond Incentive Pay: Insiders' Estimates of the Value of Complementary Human Resource Management Practices," *Journal of Economic Perspectives*, 7, pp. 155-180.

Ichniowski, C. and K. Shaw (2007), "Insider Econometrics," Forthcoming in R. Gibbons and J. Roberts, eds., *Handbook of Organizational Economics*.

Ichniowski, C., K. Shaw, and G. Prennushi (1997), "The Effects of Human Resource Management on Productivity: A Study of Steel Finishing Lines," *American Economic Review*, 87, pp. 291-313.

Ito, T. (1992), *The Japanese Economy* (MIT Press: Cambridge, MA).

Kagono, T., I. Nonaka, K. Sakakibara, and A. Okumura (1985), *Strategic vs. Evolutionary Management: A US-Japan Comparison of Strategy and Organization* (North-Holland: Amsterdam, The Netherlands).

Kahn, L.B. (2006), "The Long-Term Labor Market Consequences of Graduating from College in a Bad Economy," Mimeo, Harvard University.

Kandel, E. and E. Lazear (1992), "Peer Pressure and Partnership," *Journal of Political Economy*, 100, pp. 801-817.

Kato, T. (2001), "The End of Lifetime Employment in Japan: Evidence from National Surveys and Field Research," *Journal of the Japanese and International Economies*, 15, pp. 489- 514.

Katz, E. and A. Ziderman (1990), "Investment in General Training: The Role of Information and Labour Mobility," *Economic Journal*, 100, pp. 1147-1158.

Kelley, M.E. (1996), "Participatory Bureaucracy and Productivity in the Machined Products Sector," *Industrial Relations*, 35, pp. 374-399.

Knez, M. and D. Simester (2001), "Firm-Wide Incentives and Mutual Moritoring at Continental Airlines," *Journal of Labor Economics*, 19, pp. 743-772.

Kochan, T.A., H.C. Katz, and R.B. McKersie (1986), *The Transformation of American Industrial Relations* (Basic Books: New York).

Koike, K. (1977), *Shokuba No Rodokumiai To Sanka (Labor Union of Workplace and Participation*) (Toyokeizai Shinposha: Tokyo).

Koike, K. (1988), *Understanding Industrial Relations in Modern Japan* (St. Martin's Press: New York).

Krafcik, J. (1988), "Triumph of the Lean Production System," *Sloan Management Review*, 30, pp. 41-52.

Kreps, D. (1990), "Corporate Culture and Economic Theory," in J. Alt and K. Shepsle, eds., *Perspectives on Positive Political Econom*y (Cambridge University Press: New York), pp. 90-143.

Krueger, A. (1991), "Ownership, Agency, and Wages: An Examination of Franchising in the Fast Food Industry," *Quarterly Journal of Economics*, 106, pp. 75-101.

Lambert, R., D. Larcker, and K. Weigelt (1993), "The Structure of Organizational Incentives," *Administrative Science Quarterly*, 38, pp. 438-461.

Lawler, E.E., S.A. Mohrman, and G.E. Ledford Jr. (1995), *Creating High Performance Organizations: Practices and Results of Employee Involvement and Total Quality Management in Fortune 1000 Companies* (Jossey-Bass: San Francisco, CA).

Lazear, E. (1979), "Why is there Mandatory Retirement?," *Journal of Political Economy*, 87, pp. 1261-1284.

Lazear, E. (1981), "Agency, Earnings Profiles, Productivity and Hours Restrictions," *American Economic Review*, 71, pp. 606-620.

Lazear, E. (1986), "Salaries and Piece Rates," *Journal of Business*, 59, pp. 405-431.

Lazear, E. (1992), "The Job as a Concept," in W. Bruns, ed., *Performance Measurement, Evaluations, and Incentives* (Harvard University Press: Boston, MA), pp. 183-215.

Lazear, E. (1999), "Personnel Economics: Past Lessons and Future Directions," *Journal of Labor Economics*, 17, pp. 199-236.

Lazear, E. (2000), "Performance Pay and Productivity," *American Economic Review*, 90, pp. 1346-1361.

Lazear, E. and P. Oyer (2004), "Internal and External Labor Markets: A Personnel Economics Approach," *Labour Economics*, 11, pp. 527-554.

Lazear, E. and P. Oyer (2007), "Personnel Economics," Forthcoming in R. Gibbons and J. Roberts, eds., *Handbook of Organizational Economics*.

Lazear, E. and S. Rosen (1981), "Rank-Order Tournaments as Optimum Labor Contracts," *Journal of Political Economy*, 89, pp. 841-864.

Lillard, L. and Y. Weiss (1979), "Components of Variation in Panel Data: American Scientists 1960-1970," *Econometrica*, 47, pp. 437-454.

Lima, F. and P.T. Pereira (2003), "Careers and Wages within Large Firms: Evidence from a Matched Employer-Employee Data Set," *International Journal of Manpower*, 24, pp. 812-835.

Lin, M.J. (2005), "Opening the Black Box: The Internal Labor Markets of Company X," *Industrial Relations*, 44, pp. 659-706.

Lincoln, R.J., M. Hanada, and K. McBride (1986), "Organizational Structures in Japanese and US Manufacturing," *Administrative Science Quarterly*, 31, pp. 338-364.

Lluis, S. (2005), "The Role of Comparative Advantage and Learning in Wage Dynamics and Intrafirm Mobility: Evidence from Germany," *Journal of Labor Economics*, 23, pp. 725- 768.

Lynch, L. (2007), "The Adoption and Diffusion of Organizational Innovation: Evidence for the U.S. Economy," IZA Discussion Paper No. 2819.

MacDuffie, J.P. (1995), "Human Resource Bundles and Manufacturing Performance: Organizational Logic and Flexible Production Systems in the World Auto Industry," *Industrial and Labor Relations Review*, 48, pp. 197-221.

MacDuffie, J.P. and T. Kochan (1995), "Do US Firms Invest Less in Human Resources? Training in the World Auto Industry," *Industrial Relations*, 34, pp. 147-168.

MacDuffie, J.P. and F. Pil (1996), "The Adoption of High Involvement Work Practices," *Industrial Relations*, 35, pp. 423-455.

Main, B.G.M., C.A. O'Reilly III, and J. Wade (1993), "Top Executive Pay: Tournaments or Teamwork?," *Journal of Labor Economics*, 11, pp. 606-628.

Malcomson, J.M. (1984), "Work Incentives, Hierarchy, and Internal Labor Markets," *Journal of Political Economy*, 92, pp. 486-507.

McCue, K. (1996), "Promotions and Wage Growth," *Journal of Labor Economics*, 14, pp. 175-209.

McLaughlin, K.J. (1994), "Rigid Wages," *Journal of Monetary Economics*, 34, pp. 383-414.

Medoff, J. and K. Abraham (1980), "Experience, Performance, and Earnings," *Quarterly Journal of Economics*, 95, pp. 703-736.

Medoff, J. and K. Abraham (1981), "Are Those Paid More Really More Productive?," *Journal of Human Resources*, 16, pp. 186-216.

Meyer, M.A. (1992), "Biased Contests and Moral Hazard: Implications for Career Profiles," *Annales d'Economic et de Statistique*, 25/26, pp. 165-187.

Meyer, M.A. (1994), "The Dynamics of Learning with Team Production: Implications for Task Assignment," *Quarterly Journal of Economics*, 109, pp. 1157-1184.

Michie, J. and M. Sheehan (1999), "HR Practices, R&D Expenditures and Innovative Investment: Evidence from the U.K.'s Workplace Industrial Relations Survey," *Industrial and Corporate Change*, 8, pp. 211-233.

Milgrom, P. (1988), "Employment Contracts, Influence Activities and Efficient Organization Design," *Journal of Political Economy*, 96, pp. 42-60.

Milgrom, P. and J. Roberts (1988), "An Economic Approach to Influence Activities in Organizations," *American Journal of Sociology*, 94, pp. S154-S179.

Milgrom, P. and J. Roberts (1990), "The Economics of Modern Manufacturing: Technology, Strategy, and Organization," *American Economic Review*, 80, pp. 511-528.

Milgrom, P. and J. Roberts (1995), "Complementarities and Fit: Strategy, Structure, and Organizational Change in Manufacturing," *Journal of Accounting and Economics*, 19, pp. 179-208.

Mincer, J. (1974), *Schooling, Experience, and Earnings* (NBER: New York).

Mincer, J. and Y. Higuchi (1988), "Wage Structures and Labor Turnover in the United States and Japan," *Journal of the Japanese and International Economies*, 2, pp. 97-133.

Mookherjee, D. (1984), "Optimum Incentive Schemes with Many Agents," *Review of Economic Studies*, 51, pp. 433-446.

Morita, H. (2001), "Choice of Technology and Labor Market Consequences: An Explanation of US-Japanese Differences," *Economic Journal*, 111, pp. 29-50.

Morita, H. (2005), "Multi-skilling, Delegation and Continuous Process Improvement: A Comparative Analysis of US-Japanese Work Organizations," *Economica*, 72, pp. 69-93.

Munasinghe, L. (2005), "A Theory of Wage and Turnover Dynamics," Mimeo, Columbia University.

Murphy, K.J. (1985), "Corporate Performance and Managerial Remuneration: An Empirical Analysis," *Journal of Accounting and Economics*, 7, pp. 11-42.

Nagin, D., J. Rebitzer, S. Sanders, and L. Taylor (2002), "Monitoring, Motivation and Management: The Determinants of Opportunistic Behavior in a Field Experiment," *American Economic Review*, 92, pp. 850-873.

Nalebuff, B.J. and J.E. Stiglitz (1983), "Prizes and Incentives: Towards a General Theory of Compensation and Competition," *Bell Journal of Economics*, 14, pp. 21-43.

O'Reilly III, C., B. Main, and G. Crystal (1988), "CEO Compensation as Tournament and Social Comparison: A Tale of Two Theories," *Administrative Science Quarterly*, 33, pp. 257- 274.

Oreopoulos, P., T. von Wachter, and A. Heisz (2006), "The Short- and Long-Term Career Effects of Graduating in a Recession: Hysteresis and Heterogeneity in the Market for College Graduates," NBER Working Paper No. 12159.

Ortega, J. (2001), "Job Rotation as a Learning Mechanism," *Management Science*, 47, pp. 1361-1370.

Osterman, P. (1994), "How Common is Workplace Transformation and Who Adopts It?," *Industrial and Labor Relations Review*, 47, pp. 173-188.

Osterman, P. (2000), "Work Reorganization in an Era of Restructuring: Trends in Diffusion and Effects of Employee Welfare," *Industrial and Labor Relations Review*, 53, pp. 179-196.

Owan, H. (1999), *Internal Organization, Bargaining, and Human Capital*, Unpublished Ph.D. Dissertation, Stanford University.

Owan, H. (2004), "Promotion, Turnover, Earnings, and Firm-Sponsored Training," *Journal of Labor Economics*, 22, pp. 955-978.

Oyer, P. (2006), "Initial Labor Market Conditions and Long-Term Outcomes for Economists," *Journal of Economic Perspectives*, 20, pp. 143-160.

Oyer, P. (2007), "Is There an Insider Advantage in Getting Tenure?," *American Economic Review*, 97, pp. 501-505.

Podolny, J.M. and J.N. Baron (1997), "Resources and Relationships: Social Networks and Mobility in the Workplace," *American Sociological Review*, 62, pp. 673-693.

Prendergast, C. (1989), *Theories of Internal Labor Markets*, Unpublished Ph.D. Dissertation, Yale University.

Prendergast, C. (1992), "Career Development and Specific Human Capital Collection," *Journal of the Japanese and International Economies*, 6, pp. 207-227.

Prendergast, C. (1999), "The Provision of Incentives in Firms," *Journal of Economic Literature*, 37, pp. 7-63.

Ricart i Costa, J. (1988), "Managerial Task Assignments and Promotions," *Econometrica*, 56, pp. 449-466.

Ricchetti, B.M. (2007), *Essays in Labor and Organization Economics*, Unpublished Ph.D. Dissertation, Cornell University.

Rosen, S. (1982), "Authority, Control, and the Distribution of Earnings," *Bell Journal of Economics*, 13, pp. 311-323.

Rosen, S. (1986), "Prizes and Incentives in Elimination Tournaments," *American Economic Review*, 76, pp. 701-715.

Rosenbaum, J. (1984), *Career Mobility in a Corporate Hierarchy* (Academic Press: New York).

Rotemberg, J.J. (1994), "Human Relations in the Workplace," *Journal of Political Economy*, 102, pp. 684-717.

Rubinstein, Y. and Y. Weiss (2007), "Post Schooling Wage Growth: Investment, Search and Learning," Forthcoming in E.A. Hanushek and F. Welch, eds., *Handbook of the Economics of Education, Vol. 1*.

Shapiro, C. and J.E. Stiglitz (1984), "Equilibrium Unemployment as a Worker Discipline Device," *American Economic Review*, 74, pp. 433-444.

Shavell, S. (1979), "Risk Sharing and Incentives in the Principal and Agent Relationship," *Bell Journal of Economics*, 10, pp. 55-73.

Shepard, A. (1993), "Contractual Form, Retail Price, and Asset Characteristics in Gasoline Retailing," *Rand Journal of Economics*, 24, pp. 58-77.

Slade, M. (1996), "Multitask Agency and Organizational Form: An Empirical Exploration," *International Economic Review*, 37, pp. 465-486.

Topel, R.H. (1991), "Specific Capital, Mobility, and Wages: Wages Rise with Job Seniority," *Journal of Political Economy*, 99, pp. 145-176.

Topel, R.H. and M.P. Ward (1992), "Job Mobility and the Careers of Young Men," *Quarterly Journal of Economics*, 107, pp. 439-479.

Treble, J., E.V. Cameren, S. Bridges, and T. Barmby (2001), "The Internal Economics of the Firm: Further Evidence from Personnel Data," *Journal of Labor Economics*, 8, pp. 531-552.

Umezaki, O. (2001), *Nihon Kigyo Ni Okeru Howaito Karah No Shokuba Soshiki To Jinteki Shigen Kanri (Work Organization and Human Resource Management of White-Collar Workers in the Japanese Firm)*, Unpublished Ph.D. Dissertation, University of Osaka.

Waldman, M. (1984a), "Job Assignments, Signalling, and Efficiency," *Rand Journal of Economics*, 15, pp. 255-267.

Waldman, M. (1984b), "Worker Allocation, Hierarchies, and the Wage Distribution," *Review of Economic Studies*, 51, pp. 95-109.

Waldman, M. (1990), "Up-or-Out Contracts: A Signaling Perspective," *Journal of Labor Economics*, 8, pp. 230-250.

Waldman, M. (2003), "Ex Ante Versus Ex Post Optimal Promotion Rules: The Case of Internal Promotion," *Economic Inquiry*, 41, pp. 27-41.

Weiss, Y. (1984), "Wage Contracts When Output Grows Stochastically: The Roles of Mobility Costs and Capital Market Imperfections," *Journal of Labor Economics*, 2, pp. 155-173.

Willis, R.J. (1986), "Wage Determinants: A Survey and Reinterpretation of Human Capital Earnings Functions," in O. Ashenfelter and R. Layard, eds., *Handbook of Labor Economics, Vol. 1* (North- Holland: Amsterdam, The Netherlands), pp. 525-602.

Wilms, W. (1995), *NUMMI: An Ethnographic Study* (The Free Press: New York).

Zabojnik, J. (2002), "Centralized and Decentralized Decision Making in Organizations," *Journal of Labor Economics*, 20, pp. 1-22.

Zabojnik, J. and D. Bernhardt (2001), "Corporate Tournaments, Human Capital Acquisition, and the Firm Size-Wage Relation," *Review of Economic Studies*, 68, pp. 693-716.