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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.

**Keywords**
internal labor markets, wage and promotion dynamics, human resources, human-resource practices

**Comments**

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# THEORY AND EVIDENCE IN INTERNAL LABOR MARKETS

(Prepared for the Forthcoming *Handbook of Organizational Economics*)

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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 (2008) 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. Important papers here 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 a job ladder. Clearly these are important contributions. But mostly these papers were not focused on 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 large wage increases associated with promotion, and Waldman (1984a) which explores the signaling role of promotions and provides a competing explanation for large wage increases upon promotion.

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[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."

But as the literature has matured, two related questions have become central. First, when there are competing theories for a phenomenon, which one best captures the correct real-world explanation? For example, both tournament theory and promotions serving as signals provide explanations for why promotions are typically associated with large wage increases. How should we choose between these theories, or possibly, what would lead us to conclude 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.

More recent literature makes progress on these issues in one of two ways. First, on the empirical side, rather than focusing on a single fact or phenomenon, many papers present a pattern of evidence on related issues. Early papers in this category are Medoff and Abraham's (1980,1981) papers on performance evaluations and wages. More recent important papers 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 model is consistent with patterns in the empirical evidence rather than a single fact or empirical phenomenon. Examples of papers here 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 concerning innovative work practices, while Bernhardt (1995) and Gibbons and Waldman (1999b,2006) provide models that explain various findings concerning wage and promotion dynamics inside firms.

This survey focuses on this agenda. That is, it focuses on how patterns of evidence can be used 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 providing a comprehensive survey of the internal-labor-market literature, I consider specific topics where 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 these 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) Basic Empirical Findings

Although most findings in this subsection appear in Baker, Gibbs and Holmstrom's (1994a,b), 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 data is 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 white-collar workers while others consider both blue- and white-collar workers. For each finding I provide a list of papers that find supporting evidence (and where appropriate papers that find contradictory evidence), but because of the recent rapid growth in this literature I do not attempt to provide 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 is found in Baker, Gibbs, and Holmstrom (1994a,b), McLaughlin (1994), and Card and Hyslop (1997). Baker, Gibbs, and Holmstrom find that real-wage decreases are more frequent in high-inflation environments which suggests a lag in the wage-adjustment process, but some real-wage decreases are seen even with low inflation. The same papers find evidence of a low rate of nominal wage decreases. In terms of demotions, in addition to Baker, Gibbs, and Holmstrom, a number of studies including Seltzer and Merrett (2000) and Treble et al. (2001) find that demotions are rare. A few exceptions, however, find a significant rate of demotions including Dohmen, Kriechel, and Pfann's (2004) study of Fokker Aircraft's decline and Lin's (2005) study of low-level salespersons in a Taiwanese firm.

A second finding with significant 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 is found in Rosenbaum (1984), Baker, Gibbs, and Holmstrom (1994a,b), and Podolny and Baron (1997). Recently, Belzil and Bognanno (2004) use a structural-estimation approach to investigate 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. Belzil and Bognanno's findings suggest that fast tracks are mostly driven by workers with certain types

characteristics having a high probability of earning multiple promotions, as opposed to an early promotion increasing the probability of a quick subsequent promotion.

A third finding is serial correlation in wage changes. Here the evidence is mixed. Evidence in favor of the finding appears 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. Studies such as Abowd and Card (1989), Topel (1991), and Topel and Ward (1992) look at heterogenous samples such as the Panel Study of Income Dynamics (PSID) and do not find the result. One exception is Baker (1997) which finds serial correlation in wage changes using the PSID. A possible reason that paper finds different results is that it considers a larger panel than the other studies and also uses different econometric tests.

Another finding, this one 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). There is also strong evidence, however, that wage increases at promotion are small relative to the difference between average wages across adjacent job levels. This is found in Baker, Gibbs, and Holmstrom (1994a,b), Murphy (1985), and Main, O'Reilly, and Wade (1993). Evidence in Murphy (1985) nicely illustrates the finding. In a study of large US manufacturing firms Murphy found that: i) the average real increase for vice presidents promoted to president was 21 percent; and ii) the average salary plus bonus for presidents was 60 percent higher than for vice presidents. Although at first these findings may seem contradictory, as 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 related evidence is found in McCue (1996). The last finding is that wages exhibit cohort effects, i.e., a cohort's wage as it ages is related to 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, related findings appear in Beaudry and DiNardo (1991) which is discussed in more detail later.

B) The Role of Schooling

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 it, 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. Lluis (2005) also shows a related finding. As will be discussed in the next section, one explanation for why schooling is positively related to promotion probabilities is schooling is positively related to worker ability and worker ability is positively related to promotion probabilities. This suggests that controlling for worker ability should weaken the positive relationship between schooling and promotion probability. 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 positive relationship between schooling and promotion probabilities becomes weaker.

A third 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.

A final finding, where the evidence is mixed, concerns schooling and the returns to experience. Farber and Gibbons (1996) using data from the National Longitudinal Survey of Youth (NLSY) regress the wage level on various variables including schooling, experience, experience squared, a test score unobserved by employers, and various interaction terms. 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 Current Population Survey (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 study 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

The final issue I consider is the role of performance evaluations. Few papers have considered this topic so many of the results are taken from Medoff and Abraham (1980,1981). Medoff and Abraham's main focus was on a discrepancy between the way wages depend on labor-market experience and firm tenure and the way 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 these variables. In interpreting their results they question the idea that much of wage growth is the result of accumulation of human capital, but as I discuss later there are other possibilities.

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[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.

A related finding is that the magnitude of the negative relationship between performance evaluations and labor-market experience depends on the manner in which the test is conducted. Specifically, 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). This finding suggests that 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 evalutions today predict good future outcomes. For example, Medoff and Abraham (1980,1981), Dohmen (2004), and DeVaro and Waldman (2007) find that performance evaluations are positively related to future promotions and future wage increases. Also, as is discussed in more detail later, DeVaro and Waldman find that the performance required to achieve a promotion falls with the worker's education level.

A final point here is that in considering Medoff and Abraham' interpretation of their results an important consideration is what performance evaluations actually measure. If performance evaluations are an unbiased measure of productivity, then Medoff and Abraham's interpretation of their main findings would almost have to be correct. But that this is the case is not clear cut. It is quite possible that workers are evaluated relative to a specific set of peers, where the comparison group changes over time as workers age and move up the job ladder. As is discussed in more detail later, if this is the case, then other possibilities arise concerning what may be driving Medoff and Abraham's main findings.

## III. FOUR CANDIDATE MODELS

This section discusses four theoretical approaches that can be used to address the empirical facts presented above. These are: i) symmetric learning and insurance; ii) the

tournament approach; iii) promotions as signals; and iv) symmetric learning with human capital acquisition and job assignment.[4] The end of the section provides an overview and synthesis.

A) Symmetric Learning and Insurance

This subsection discusses Harris and Holmstrom's (1982) model of symmetric learning and insurance (also see Freeman (1977)). 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 Holmstrom assume long-term contracting is feasible but also realistically that a worker cannot commit not to leave his or her current employer in order to accept a higher wage elsewhere.

Equilibrium contracts consist of a downward rigid wage but the wage may increase over time depending on subsequent output realizations. The downward rigid wage provides partial

[4] There are other theoretical approaches one might consider. These include 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), influence costs as found, for example, in Milgrom (1988) and Milgrom and Roberts (1988), and 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.

insurance, where full insurance is not feasible because workers cannot commit not to leave later for a 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 fewer 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 future expected productivity is anticipated to vary little.

2) Theoretical Extensions and Empirical Tests

A related theoretical analysis appears in Weiss (1984). In that analysis realized productivity in any period is stochastic and expected productivity grows stochastically as workers age where expected future productivity depends positively on previous productivity. 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 occur if the stochastic process eventually results in sufficiently high expected productivity.

There have been a few empirical 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 National Longitudinal Surveys and also finds supportive evidence.

A different test is investigated in Chiappori, Salanie, and Valentin (1999). They first extend the model to show that "late beginners" do better than "early starters." That is, holding fixed the wage at date t, the wage at t+1 is negatively correlated with the wage at t-1, i.e., higher recent wage growth on average translates into higher subsequent wage growth. The authors then find supporting evidence using managerial data from a large French state-owned firm. Note, the fact they find supporting evidence is not surprising since the prediction is similar to serial correlation in wage increases which, as was discussed earlier, has been found in a number of studies. In addition, one drawback of this test, which is discussed by Chiappori, Salanie, and Valentin, is that there is an alternative explanation. The same prediction follows if wages equal expected productivity and changes in productivity growth are positively correlated over time as in, for example, Gibbons and Waldman (1999b,2006).

3) Pros and Cons

There are a number of positives concerning this theory. First, it explains the Medoff and Abraham finding that wages on average rise with experience even though performance evaluations do not. That is, assume performance evaluations not increasing with labor-market experience means average productivity does not increase with experience. Then the Harris and Holmstrom analysis exactly captures this Medoff and Abraham finding. In their model expected productivity is independent of labor-market experience. Yet, the average wage increases with experience because of the downward rigidity of wages and because, as discussed, the insurance premium falls with 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. 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 tests 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 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 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) which was the first major theoretical study to focus on the important role of promotions in worker compensation. Most of the discussion focuses on Lazear and Rosen's analysis, although I do discuss a few later papers. As is also discussed, there is clear empirical support for the main ideas underlying tournament theory, but in general this literature has not explored the extent to which the theory can explain many of the 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 a larger spread means higher equilibrium effort. 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 due to the higher wages a higher effort level requires, 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 exert effort because doing so increases the probability of receiving these prizes.

Lazear and Rosen also discuss and analyze the circumstances in which labor-market tournaments are preferable to alternative ways of motivating workers when effort is not directly observable. They first show that given risk neutrality 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. I come back to this issue below.

2) Theoretical Extensions and Empirical Tests

A large literature extends Lazear and Rosen's (1981) analysis. 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, these two papers 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 which concerns savings on information costs, Malcomson (1984) argues that tournaments may be employed because individual performance is not verifiable so individual contracting is difficult to enforce.

Other papers model a tournament that consists of several rounds or contests. Clearly, real-world promotion tournaments do not consist of a single contest, but rather promotion to a higher level job is typically 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 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.[5] The paper thus provides an explanation for why wage increases associated with being promoted to the top levels of firms seem to be especially large as found, for example, in Murphy (1985) and Baker, Gibbs, and Holmstrom (1994a,b).[6]

There is also a substantial literature focused on testing implications of tournament theory. 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 effort being positively related to the spread. Although of interest, I find this set of findings weak in terms of how strongly they support traditional tournament theory. These tests provide evidence that the individuals in the tournament behave in a fashion consistent with utility maximization, i.e., effort increases when the winning prize is higher. This does not tell us anything about whether, as is true in classic tournament theory, firms commit to optimal prizes in advance of the actual promotion decision.

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[5] See Prendergast (1999) for an interesting discussion of what drives this result in Rosen's analysis.

[6] Other important theoretical extensions of the basic tournament model include Lazear's (1989) model of sabotage and wage compression (see also Garvey and Swan (1992) and Drago and Garvey (1998)) and models that show that tournaments can lead firms to favor insiders relative to outsiders when deciding whom to promote (see Malcomosn (1984), Chan (1996), and Waldman (2003)).

Another set of papers focus on predictions concerning firm behavior derived 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 logic of this prediction is that increasing the number of workers competing for a promotion typically reduces equilibrium effort levels and in response the firm increases the spread.[7] Main, O'Reilly, and Wade (1993), Eriksson (1999), and Bognanno (2001) find supporting evidence, while O'Reilly, Main, and Crystal (1988) do not.

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. As discussed above the worker effort prediction seems not so closely tied to tournament theory, while the firm-side predictions are derived from classic tournament theory's assumption that firms commit to promotion prizes with incentives in mind. However, there are potential alternative explanations. First, as discussed later, the idea that the wage increase due to promotion is related to the number of workers at the job from which the promoted worker is drawn can be explained using the promotion-as-signal hypothesis. Second, convexity of the wage structure could be due to various factors such as income effects resulting in higher wage increases on promotion to higher ranks. The logic is that, due to income effects, at these higher ranks higher wages are needed to induce effort.[8]

More recently, DeVaro (2006a,b) uses a structural-estimation approach to consider simultaneously worker-effort and firm-side predictions of tournament theory. DeVaro looks at a

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

[8] Recently, Oyer (2007) tests a third firm-side prediction. As mentioned in footnote 6, a number of extensions of the basic tournament model predict firms favor insiders over outsiders in promotion decisions. Oyer tests this prediction by looking at tenure decisions in economics departments and finds supporting evidence. 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, this finding could also be explained by asymmetric learning as in Greenwald (1979,1986) and by influence activities as in Milgrom (1988) and Milgrom and Roberts (1988).

sample of skilled workers taken from a cross-section of establishments. Using a structural-estimation approach that treats promotions, wage spreads, and performance as endogenous, he finds support for both types of predictions. Specifically, he finds results consistent with firms choosing spreads optimally and worker effort being higher when spreads are larger.

3) Pros and Cons

There are clearly strong positives associated with tournament theory. Probably the most important is the plausibility of the central ideas captured by the argument. Clearly, the possibility of promotion does serve as an 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 most studies that have tested implications of tournament theory have found supportive evidence. As discussed above, there is substantial evidence that as the model predicts, holding average wages fixed, worker effort is positively related to the spread between winning and losing. Also, studies generally find that compensation varies 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 can capture 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 cohort effects being important. 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 a newly promoted worker's wage seems to depend both on worker attributes and performance. Similarly, the Lazear and Rosen approach incorporates the market in a very limited way. That is, in initially attracting workers the firm must offer wages that translate into an expected utility at least as high as some reservation value, but there are no similar participation constraints after promotion decisions take place. This also seems inconsistent with Baker, Gibbs, and Holmstrom (1994a,b) and similar papers where workers enter and leave at all levels of the job ladder. As discussed further below, possibly the answer to these drawbacks is that there are labor-market tournaments but they take a somewhat different form than initially modeled by Lazear and Rosen.

C) Promotions as Signals

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

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. 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 action is the promotion decision.

In Waldman's two-period model workers vary in their innate ability levels but look identical upon labor-market entry. Firms are characterized by two jobs – a low-level job where the return to ability is low and a high-level job where it 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 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 first-best efficient. The reason is that a promotion serves as a signal that worker ability is high, so after a promotion other firms 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 causes firms to only promote workers who are significantly more productive in the high-level job.[9]

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 workers vary in terms of their publicly-observed schooling levels. What happens 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 and fewer workers are promoted than in the first best.

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

[9] One difference between tournament theory and the arguments discussed here and in the next subsection is that in tournament theory a promotion does not result in a change in the set of tasks performed while in these other arguments it does. The only relevant empirical work I am familiar with is Pergamit and Veum (1999). In their study of young workers approximately seventy percent of promoted workers were given additional responsibilities in their current job or position or were moved to a new job or position.

example, Bernhardt finds that firms favor more highly educated workers in the promotion process. That is, holding true productivity fixed, 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. The most important extension appears in Zabojnik and Bernhardt (2001).[10] That paper connects the promotion-as-signal idea to the tournament approach (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. In the Zabojnik and Bernhardt model the tournament instead arises endogenously from asymmetric learning and the resulting signaling aspect of promotions. That is, rather than firms committing to a prize associated with promotion, prizes arise endogenously because promotions serve as signals and large wage increases are 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 explains various findings in the firm-size-wage-effects literature and the interindustry-wage-differences literature.[11]

On the empirical side there have been a number of tests of asymmetric learning in labor markets, but only one that looks at the promotion-as-signal hypothesis. The classic test of

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[10] Other related theory papers include Milgrom and Oster (1987), Ricart i Costa (1988), MacLeod and Malcomson (1988), Waldman (1990), Bernhardt and Scoones (1993), and Owan (2004). Also, see Ishida (2004a,b) for interesting analyses that focus on the interaction between education as a signal and promotion as a signal.

[11] The Zabojnik and Bernhardt argument also serves as an explanation for the puzzle first identified in Baker, Jensen and Murphy (1988) which is, why are promotions used as incentive devices given this creates inefficiencies since the incentive and allocation roles of promotion will sometimes be in conflict? An alternative explanation for this puzzle is found in Fairburn and Malcomson (2001) which is based on the idea that bonus-based incentives are subject to the negative effects of influence activities.

asymmetric learning in labor markets is found in Gibbons and Katz (1991) which builds on Greenwald's (1979,1986) analysis of adverse selection in labor-market turnover. Gibbons and Katz argue that laid-off workers 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.[12] 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. Using data from the CPS Gibbons and Katz find evidence that supports all three predictions.

There have been a number of follow-up studies and the evidence is mixed concerning whether the Gibbons and Katz results are in fact due to asymmetric learning. Acemoglu and Pischke (1998), which is discussed in more detail later, extend the theoretical framework to consider incentives for firms to provide their workers with general human capital and then show supporting evidence using German data. But a number of other studies that have looked more directly at the Gibbons and Katz results argue that their results are explained by something other than asymmetric learning. For example, Krashinsky (2002) argues that the results are due to laid-off workers being displaced from larger establishments which pay higher predisplacement wages, while Song (2007) makes a similar argument and also argues that recall bias is important (see also Doiron (1995), Stevens (1997), and Grund (1999)).

More recently, a number of papers have developed other predictions of asymmetric learning and these papers mostly find supporting evidence. Specifically, Schonberg (2007) finds evidence consistent with asymmetric learning for university graduates but not for high school

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

graduates and dropouts,[13] while Kahn (2007), Zhang (2007), and Pinkston (2008) all find general support for asymmetric learning across a variety of tests.

Finally, the only empirical analysis focused directly on the promotion-as-signal hypothesis is found in DeVaro and Waldman (2007) (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 use this result to derive two testable implications: i) holding performance fixed, the probability of promotion should be an increasing function of the education level; and ii) the wage increase due to promotion should be a decreasing function of the eductation level. They then show supporting evidence using the same data set investigated in the Baker, Gibbs, and Holmstrom (1994a,b) 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.

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,

[13] To be precise, Schonberg develops two testable implictions for asymmetric learning. The first which she finds clear evidence for among university graduates is the result originally due to Greenwald that workers who turnover should be drawn from the low end of the ability distribution. The second is that in a world of asymmetric learning the return to ability should be positively related to tenure at the firm. For this prediction she finds mixed evidence concerning university graduates. However, although the second testable implication is predicted by the specific model of asymmetric learning she considers, I do not believe it is a robust prediction of such models. So my feeling is that Schonberg's findings are consistent with asymmetric learning being important for university graduates.

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, on net I believe the various empirical studies in the literature support asymmetric learning as an important factor in real-world labor markets. Second, the only empirical investigation of the promotion-as-signal hyothesis is found in DeVaro and Waldman (2007) which finds evidence consistent with the hypothesis. Third, the hypothesis is consistent with two important empirical findings concerning promotions, i.e., large wage increases upon promotion but these wage increases are small relative to wage differences across adjacent job levels.[14]

In addition to the positives discussed above, there are also 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, in most pure asymmetric-learning models a worker's salary increase in a period in which there is no promotion is completely determined by observable characteristics such as schooling, labor-market experience, and firm tenure. But numerous studies such as Baker, Gibbs, and Holmstrom (1994a,b) make it clear that this is not the case. Second, the approach does not easily explain why 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 will not reveal positive information about a worker when there is no return in terms of productivity, so in the absence of promotions the firm should not give higher wage increases to the higher productivity workers.[15]

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[14] 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 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.

[15] See Pinkston (2008) for an asymmetric-learning model not subject to these criticisms. Also, the second criticism above implicitly assumes workers with the same observable characteristics. If workers have different observable

D) Symmetric Learning with Human-Capital Acquisition and Job Assignment

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 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 as I discuss.

1) Basic Description

As indicated, Gibbons and Waldman combine symmetric learning, human-capital accumulation, and job assignment. In their model workers look identical upon labor-market entry but in fact vary in terms of their innate abilities, where at the end of each period firms observe worker outputs and update their beliefs concerning each worker's ability. As in Harris and Holmstrom (1982) discussed earlier, 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 each worker's "effective" ability grows over time although expected effective ability falls when output is very low. Further, the human-capital-accumulation process is multiplicative, i.e., workers with higher innate ability accumulate human capital at a faster rate. Also, there are three job levels which vary in terms of the marginal return to 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 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-

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 empirically investigate this argument.

wage decreases are not rare because with learning a worker receives a real-wage decrease when realized output is so low that expected effective ability falls, but this rarely translates into a demotion since 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 have large increases in expected effective ability, and that large wage increases early at a job level predict quicker promotion. This follows since a large wage increase early on means significant growth in expected effective ability which means that, on average, the worker achieves the expected effective ability required for promotion more quickly. The model also explains serial correlation in wage changes, that wage increases at promotion are small relative to the difference between average wages across adjacent job levels, and is consistent with serial correlation in promotion rates.[16]

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 fall with experience because workers with high expected innate ability are promoted out of the job as they age while those with low expected ability are promoted into the job. The framework also explains differences between cross-sectional and longitudinal analyses of the same data set and why performance evaluations predict both future promotions and future wage increases.

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[16] Gibbons and Waldman show serial correlation in promotion rates in their full-information benchmark analysis, but the framework does not necessarily exhibit serial correlation in promotion rates given symmetric learning.

2. Theoretical Extensions and Related Empirical Tests

Important 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. In this model workers vary in terms of their schooling levels, where higher schooling means higher expected innate ability. They show that with this enrichment the model captures 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 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 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 their 2006 paper shows that the framework is consistent with cohort effects when task-specific human capital is added. Task-specific human capital means human capital accumulated in one period is more valuable later when the worker is performing similar tasks. Specifically, Gibbons and Waldman assume an old worker assigned to the high-level job is more productive when the worker has prior experience on the high-level job. They show that with this enrichment their framework captures 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).[17]

A number of recent studies empirically estimate the Gibbons and Waldman (1999) model using large data sets from other countries (US data sets cannot typically be used for this purpose because they do not contain job-level information). One such study is Lluis (2005). She uses longitudinal data from the German Socio-Economic Panel and generalized method of moments techniques. Her results generally support the framework, although the evidence that learning helps determine job assignment is weak. In particular, the evidence is consistent with learning being important in job assignment for younger workers, but for older workers the evidence is weak.[18] She hypothesizes that the mixed evidence for learning may reflect 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 consistent with a more complete analysis of the Gibbons and Waldman framework.[19]

3. Pros and Cons

The pros here are straightforward. The theoretical analyses show that the approach can explain a 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 schooling. Also,

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[17] Dohmen (2004) finds an empirical result that supports the Gibbons and Waldman argument concerning task-specific human capital. That paper finds that a worker's performance evaluation falls after a promotion but quickly rises as the worker gains experience at the new job level. Also, Shaw and Lazear (2007) find a similar result looking directly at productivity while Gathmann and Schonberg (2007) find support for task-specific human capital in an empirical investigation of the jobs workers leave and those they move to when they switch employers.

[18] Lima and Pereira (2003) find a similar result using Portugese data Their focus is the wage premia associated with promotion, where they 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 is at the top hierarchical levels. See also Dias da Silva and van der Klaauw (2006).

[19] Another related study is Smeets and Warzynski (2008) which provides evidence concerning span of control and dynamics which they argue is consistent with an enriched version of the Gibbons and Waldman framework.

incorporating task-specific human capital, which seems realistic, allows the model to explain cohort effects which is a phenomenon that has recently gained significant empirical support.

On the negative side there are two related issues. First, Gibbons and Waldman do not consider the idea that, at least under their assumption that innate ability is a one-dimensional fixed attribute, 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 they focus on can also 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 world where innate ability is a one-dimensional fixed attribute, 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 were chosen because they were the ones 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 best explains empirical findings concerning internal-labor-market wage and promotion dynamics. Of course, it is possible this is because the other frameworks have not been developed in ways that make clear the extent to which they can 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 the evidence does not support the idea that the basic model investigated in Gibbons and Waldman (1999) is sufficient for explaining all the evidence. Rather, various enrichments seem important.[20] 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 along with recent evidence in favor of the promotion-as-signal hypothesis suggests that asymmetric learning is also important. In other words, most 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.[21]

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 spot contracting will typically give better predictions and explanations than a model in which workers are completely insulated from the aggregate labor market.[22] But there are aspects of the evidence such as nominal wage rigidity, the type of cohort effects found

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[20] See Coupe, Smeets, and Warzynski (2006) for an interesting empirical analysis of the academic economist labor market that is consistent with this view.

[21] Kahn (2007) is a recent paper that mixes symmetric and asymmetric learning in the manner I have in mind. See also Lazear (1986a), Waldman (1990), and Pinkston (2008).

[22] Lazear and Oyer (2004) show that, even in Sweden's highly regulated labor market, the "market" is important in wage determination.

by Beaudry and DiNardo, and Green Card effects 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).[23] It is an open question whether these types of deviations can be incorporated convincingly into the theoretical modeling.

As a final point, there are a few subjects that deserve more attention at both the theoretical and empirical levels. One subject is the connection between internal-labor-market wage and promotion dynamics and the turnover decision. How a worker's career progresses during a stay at a single employer should be closely related to voluntary and involuntary turnover decisions and also how the worker performs at the new job. On the empirical side a few papers develop evidence along these lines. For example, Baker, Gibbs, and Holmstrom (1994a,b) have results concerning entry and exit rates at different levels and also comparisons of wage growth and promotion outcomes for new entrants versus incumbents, while Treble et al. (2001) provides a similar analysis. But more empirical investigation of this issue would be helpful. Similarly, there is limited theoretical work on this topic and, especially if the empirical literature matures to the point that the facts are clear, more theoretical attention to the topic could prove fruitful.[24]

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 are some recent findings that suggest bonuses work quite differently than salaries. For example, Lin (2005) finds that bonuses vary more with aggregate economic conditions than do salaries and also that within a level bonuses vary more than do salaries. Also, Belzil and Bognanno (2008) find that promotions cause increases in base pay but not in bonus pay. These results suggest that salary and bonus

[23] Green Card effects refer to rules or guidelines sometimes employed that place bounds on a worker's pay increase in any period. See Milkovich and Newman (1987) and Baker, Gibbs, and Holmstrom (1994a) for discussions.
[24] Recent theoretical work that moves in this direction includes Munasinghe (2005), Ghosh (2007), and Ricchetti (2007).

play somewhat different roles in compensating workers and thus that further empirical and theoretical work on this issue could be fruitful.[25]

## 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 worker productivity. 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 differences in human-resource practices (see Ichniowski and Shaw (2003) for an earlier survey on human-resource practices).

### 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.

[25] One issue concerning bonuses that has received empirical and theoretical attention is that bonuses are more important at higher levels of job ladders. This is documented empirically in a number of places including Baker, Gibbs, and Holmstrom (1994a,b) and Ricchetti (2007). Possible theoretical explanations include that bonus payments are more important at higher job levels due to diminished career concerns as workers age (see Gibbons and Murphy (1992)), bonus payments are more important at higher levels because bonuses are more important when returns to effort are higher (see Lemieux, MacLeod, and Parent (2008)), and that incentives associated with future promotions are smaller at higher levels (see Boschmans (2008)).

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, 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 the transformation of how decisions are made. 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.[26] 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 the nature of the increased employment of these practices over time. 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

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

that employ innovative practices tend to employ larger numbers over time (see again Osterman (2000)).

B) Different Types of Evidence

Before discussing the effects on firm performance of the adoption of innovative practices, I 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 the effects found are not in fact due to the adoption of innovative work practices, but rather to some other difference that is correlated with the employment of these 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.[27]

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 Ichniowski and Shaw (2008) for a detailed description of this approach). This approach combines the best aspects of the case-study methodology with the positive aspects of systematic

[27] 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. At the 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.

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) 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, Michie 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 common over time unless there was a return associated with their use. In terms of understanding which factors 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 relates to the details concerning the manner in which innovative practices help the productivity of an existing workforce. Specifically, 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, worker productivity was increasing in the number of innovative practices employed. 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 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 practices can also translate into increased costs). As was the case for productivity, there is strong evidence that introducing innovative practices positively affects 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 weaker but 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 a 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 these 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.[28]

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, 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 in numerous studies including Milgrom and Roberts (1990), Dunlop and Weil (1996), and Bresnahan, Brynjolfsson, and Hitt (2002). This finding can be interpreted as an 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.

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[28] 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.

## 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 what are now called innovative work practices, although it is interesting to note that Lincoln has employed these practices since roughly 1945. 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 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.[29] 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.[30]

B) Four Additional Arguments Concerning Complementarities

The argument in Milgrom and Roberts (1995) concerning Lincoln Electric is just one example of theoretical arguments 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.[31] For example, Kandel and Lazear (1992) argue that firms may spend resources

[29] Theoretical analyses concerning the ratchet effect appear in Lazear (1986b), Gibbons (1987), and Carmichael and MacLeod (2000).
[30] 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.
[31] A variant of this argument appears in Che and Yoo (2001). In that paper group-based incentives are optimal in a repeated-game setting because group-based incentives lead to high worker effort through peer sanctions or mutual monitoring. After showing this Che and Yoo then show that team production and job security are employed because they are complementary to group-based incentives and peer sanctions.

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 many 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.[32]

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. In this argument decentralized decision making is employed, possibly because better decisions can be made by those with on-the-spot knowledge, and then other innovative work practices are employed because they support this decentralization (see Koike (1977,1988) and Aoki (1986,1988) for early discussions of Japanese labor market practices along this line). For example, if lower level employees make decisions, then it is important that these employees are cooperative, highly skilled, and provide high effort. 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, while group-based incentive plans should induce higher effort than the case of no-incentive pay. 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 can be assigned and this can help a firm commit to high levels of job security.

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[32] The empirical analysis in Hamilton, Nickerson, and Owan (2003) discussed earlier throws some doubt on certain aspects of this argument. 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.

The third argument is that of Holmstrom and Milgrom (1991,1994) concerning multitasking. 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 measurable. 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 invest more 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 a variant of 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.[33,34]

C) Other Theoretical Models

This subsection discusses theoretical models concerning innovative work practices that do not focus on complementarities. Rotemberg (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. Rotemberg also argues that it can be profitable for a firm to induce altruism in this type of setting by allowing time for socialization and other related behaviors. Overall, Rotemberg's argument is a quite plausible additional

[33] One problematic feature of the Aghion and Tirole framework is that delegation entails the principal giving formal authority to the agent when it is still the principal's organization, i.e., the behavior does not seem credible because in real-world organizations the principal could always undo the delegation decision (see Baker, Gibbons, and Murphy (1999) and Gibbons (2003) for discussions and analyses concerning this point). However, an alternative argument that gives similar predictions is that the principal does not delegate by ceding to the agent irrevocable control, but rather commits to delegation by ex ante choosing actions that make it costly for the principal to over-rule the agent. I would like to thank Bob Gibbons for pointing out this argument to me. Also, see Acemoglu et al. (2007) for further theory and interesting empirical evidence concerning the trade-off between incentives and agency costs in the decentralization decision.

[34] A related argument appears in Van den Steen (2007). In that argument decentralization is associated with higher incentive pay because high incentive pay in a world of centralized decision making can lead to agents who disobey the orders or instructions of their principals.

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 different job assignments, while there is also uncertainty 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.[35] 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 tenure at the firm. 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.[36]

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

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

[36] Ortega also argues that the human-capital explanation for job rotation is inconsistent with this evidence. But this seems less clear 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. Additionally, to the extent job rotation is a costly investment in human capital acquisition, then standard human capital theory suggests it should be undertaken early in careers which, in turn, is another reason why job rotation should be negatively related to firm tenure. I would like to thank Jan Zabojnik for pointing out this last argument to me.

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.[37]

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 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, a firm might 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 such identification. 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

[37] Zabojnik shows this logic is correct when it is costly for firms to induce high worker effort strictly through contracting which is the case given either liquidity constraints or risk aversion. A related argument appears in Van den Steen (2006). In that argument different priors lead to the same result that delegation can have a positive effect on worker effort, but here there is also the cost that delegation reduces coordination both inside and across firms.

opposite of what the evidence suggests. But possibly 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) Overview

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 in isolation 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. On the other hand, 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 32 for a brief discussion). On the other hand, there are other parts of that argument that seem quite plausible. For example, 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 in which decentralized decision making is employed because better decisions can be made by those with on-the-spot knowledge and, in turn, many innovative practices are employed because they are complementary with decentralization. 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.[38]

## 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

[38] 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.[39]

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 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

[39] 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 earlier 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 firms workers with the same educational background are treated similarly in terms of wages, wage growth, and

promotion rates early in careers, 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 the US than in Japan.

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)).[40]

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-

[40] 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.[41]

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.[42]

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 Koike (1977,1988) and Aoki (1986,1988) and is related to one of the arguments concerning decentralization in Subsection V.B. Basically, Morita

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[41] Although Acemoglu and Pischke's empirical work concerns Germany, since there are many similarities between German and Japanese labor markets (see Dertouzos, Lester, and Solow (1989)), their empirical findings can be interpreted as suggesting that adverse selection is also important in the Japanese labor market.

[42] 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.

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 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 explain the different equilibrium choices across the two countries.

The last theoretical argument I will 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 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.[43] Finally, Owan also 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) Convergence

As is made clear above, much of the literature on US-Japanese differences is based on data or observations decades old. 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 still is slow

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

diffusion of these practices. This suggests that, at least for the differences that are related to differences between traditional- and innovative-human-resource practices, the differences are likely 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 since the 1980s in the employment of innovative-human-resource practices in the US while there is no similar empirical literature suggesting increases over this time period 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 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 diffusion 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 should 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) Overview

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 slow diffusion, the question that remains is what drives these 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) which is related to the earlier arguments of Koike (1977,1988) and Aoki (1986,1988). 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.[44] Also, although there is empirical support for Acemoglu and Pischke's (1998) argument, the argument explains a limited number of 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.[45] Alternatively, maybe there is a way to combine Morita's and Owan's arguments.

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

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[44] 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.

[45] 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.

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. 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.[46]

## VII. CONCLUSION

The literature on internal labor markets has matured to the point that for a number of branches of the literature 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

[46] 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 were not seen in most other industrialized countries.

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.

The second literature I focused on is the literature concerning the growing use by firms of innovative-human-resource practices. After reviewing the empirical and theoretical literatures, my primary conclusion was 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 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 because better decisions are made by those with on-the-spot knowledge 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 conclusion 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 this factor into account, 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 recently by Morita (2001,2005).

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.

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