

NBER WORKING PAPER SERIES

WHAT HAPPENS WITHIN FIRMS? A  
SURVEY OF EMPIRICAL EVIDENCE ON  
COMPENSATION POLICIES

Canice Prendergast

Working Paper 5802

NATIONAL BUREAU OF ECONOMIC RESEARCH  
1050 Massachusetts Avenue  
Cambridge, MA 02138  
October 1996

Many thanks to George Akerlof, Judy Chevalier, Bob Gibbons, Mike Gibbs, Chip Heath, Nachum Sicherman, Bob Topel and an anonymous referee for helpful comments. All errors are my own. This paper is part of NBER's research program in Labor Studies. Any opinions expressed are those of the author and not those of the National Bureau of Economic Research.

© 1996 by Canice Prendergast. All rights reserved. Short sections of text, not to exceed two paragraphs, may be quoted without explicit permission provided that full credit, including © notice, is given to the source.

WHAT HAPPENS WITHIN FIRMS? A  
SURVEY OF EMPIRICAL EVIDENCE ON  
COMPENSATION POLICIES

**ABSTRACT**

This paper provides an overview of empirical work dealing with the compensation policies of firms. This literature is considered from the perspective of three major theories: human capital, learning, and incentives. Considerable empirical work has addressed each of these theories with some success. However, our understanding of the effect of compensation on behavior and of the motivations for firms in choosing certain policies has been constrained by two important problems. First, the absence of data on contracts and performance has limited the ability of researchers to ask even the most basic question, Do Incentives Matter? Second, the available theoretical work has not been sufficiently orientated towards distinguishing between plausible alternatives, so that many observed facts are consistent with any of the major theories.

Canice Prendergast  
Graduate School of Business  
University of Chicago  
1101 East 58th Street  
Chicago, IL 60637  
and NBER  
fac\_cp@gsbacd.uchicago.edu

## **I: Introduction**

The employment relation is perhaps the most important contractual relationship in the economy. The way in which this relationship translates worker preferences and capabilities into production affects the daily lives of all parties concerned. The organization of work and pay affects such diverse aspects of our lives as our education decisions, our social lives, and our effort choices. The objective of this paper is to offer some insight into the employment relationship by reviewing the available empirical work on how firms compensate their workers.

Following a long tradition from Mincer and Becker, labor economists have typically studied compensation by estimating earnings equations using individual data across a wide range of firms. The standard wage equation then identifies the reduced form mapping from worker characteristics to pay. This work has been particularly successful in understanding the effect of education, labor market experience, or training on earnings. This approach is generally associated with the human capital model of the labor market, where the regression coefficients on education, experience and tenure typically reflect the market price of those attributes. Therefore, wages reflect contemporaneous marginal product.<sup>1</sup>

The purpose of this paper is to show that factors beyond contemporaneous human capital also affect wage determination. The deviations from the human capital model will be described using two themes of the recent theoretical literature on compensation, namely, incentive theory and learning or matching theory. I begin by considering the effect of incentives on wages. There is a large theoretical literature on agency contracts, and there is empirical evidence on a wide array of workers showing how such agency considerations affect compensation. The literature has taken two conceptual approaches. Some work directly considers whether incentives matter by estimating the effect of incentive provisions on some measure of performance. A more indirect approach has

---

<sup>1</sup> Earnings equations typically include coefficients on demographic variables which are more difficult to interpret. In particular, coefficients on gender and race variables may reflect preferences for discrimination rather than reflect the marginal product of those groups. However, it is still fair to say that the standard approach to understanding earnings in the economy is firmly grounded in human capital theory.

been to test the importance of agency theory by checking whether observed contracts contain the incentive features predicted by the theory.

The second area of research surveyed examines how learning about the talents of workers affects the dynamics of wages. The purpose of this line of research is to better understand how careers develop within firms. For instance, are more able workers assigned to more suitable jobs and offered more training than their less able counterparts? If so, a considerable part of the returns to experience and tenure may be attributable to the assignment of workers to jobs, offering a social return to the information that firms collect on their workers. Related to this, another theme of the literature on careers has been on the role of jobs in the careers of workers. For instance, how important is it that workers change position for advancement?

Section III provides a critical overview of how much has been learned from the existing studies. Two themes emerge. First, I argue that an empirical identification problem and a theoretical identification problem hamper our understanding of incentive compensation. The empirical identification problem arises from the fact that different contracts are not randomly assigned to different workers. For example, suppose that one contract is offered to better workers.<sup>2</sup> If so, then simply comparing productivity under different contracts could reflect these omitted variables rather than the effect of the contracts themselves. This is the standard *empirical identification* problem well known in the literature. However, Section III also argues that it is difficult to distinguish between the theories at a conceptual level. For example, suppose that a researcher finds that individual wages rise with tenure in a firm. This finding is consistent with agency theory, learning theory, or human capital theory. To put this in more familiar terms, much of the empirical work clearly spells out its null hypothesis, but often leaves unspecified a plausible alternative hypothesis against which the theory is being compared. I call this issue *theoretical identification*. Many of the papers provide evidence that is compatible with a particular theory, but which is also compatible with some other plausible alternatives. As a result, theoretical work that intends to inform empirical work is insufficiently oriented toward distinguishing between plausible alternatives.

The second central theme of Section III is to point out data needs in this field. There is a current sentiment that enormous advances in this field can be made by studying the personnel files

---

<sup>2</sup>Available evidence clearly points to such selection.

of large companies. By doing so, researchers can develop a better understanding of the work lives than is possible with aggregate data, which are often collected on workers across many firms. I share the enthusiasm for such data sets, but believe that it will be capable of answering only a limited set of questions. As a result, I think that the greatest need in this field is to collect data on contracts themselves. Put simply, it is extremely difficult to make progress in understanding the effects of the employment contract if the contract itself cannot be observed. Some recent research in understanding the effect of incentives on performance, such as Knoeber and Thurman (1994), Chevalier and Ellison (1995), Lazear (1996) and Fernie and Metcalf (1996) has taken such a perspective with impressive results, and I conclude by arguing that more progress can be made in this manner.

## **II: Evidence on the Major Theories**

Researchers use three major theories to analyze compensation within firms: human capital, incentive theory, and learning or matching. The purpose of this section is to identify the evidence on the relevance of these theories in the data.

### ***A: Human Capital Theory***

Human capital theory argues that the primary source of variation in individual wages is the value of the individual's skills. Typically workers begin their careers at low wages, perhaps as they are paying for the cost of on-the-job training that they receive, but ultimately they earn higher wages through the use of these skills. With some further restrictions on the model, human capital theory predicts a wage that is concave in experience or tenure, as observed in the typical earnings equation.

The basic earnings equation yields reasonable estimates of a return of 7% for a year of education, and a return to labor market experience of up to 7%, though there is some dispute about the return to tenure within a firm (Topel (1991), Abraham and Farber (1987) and Altonji and Shakotko (1987)) Education and experience generate the most important differences in wages across workers but other factors also affect how wages are determined and how they change

throughout a worker's career. The papers reviewed below should be seen as evidence that factors beyond contemporaneous human capital affect wages.<sup>3</sup>

## ***B: Incentives***

Incentives are generally argued to be the cornerstone of economics, yet there is surprisingly little clear-cut evidence that changing incentive provisions within firms affects worker behavior. The available literature has taken two conceptual approaches to identifying the importance of incentive concerns. First, a relatively small number of papers have addresses the direct question "Do incentives matter?" in cases where data on contracts and productivity measures are available. Second, most of the empirical work has tested for the importance of incentives by comparing the contracts that are observed with those that 'should' arise if the theory is correct. Thus if agency theory suggests that contract X should operate in some circumstances, then the existence of contract X implies that incentives must be relevant.

### ***1. Do Incentives Matter?***

The first approach taken in the literature is to directly relate productivity measures to contracts offered. Few papers have addressed this issue for employees within firms. This is largely due to data limitations. In order to carry out such an exercise, the researcher needs to collect data on both performance measures and on the contracts offered to workers. Furthermore, the researcher must worry about the danger of selection in contracts offered. For example, if one worker is offered

---

<sup>3</sup>The tenor of the paper is that many factors other than human capital generate wages within firms. However, as an early antidote it is worth bearing in mind the findings of Brown (1989), who argues for the predominance of human capital theory in explaining wage dynamics. He argues that wage increases can only be predicted by human capital acquisition. He uses data from the PSID, where workers are asked the amount of training it would take for a replacement to be as competent as the respondent on his current job. Brown finds that individuals' wage increases can be closely approximated by the length of training time necessary on the job. After this reported training period, rewards do not increase. Brown's interpretation of this is that without human capital acquisition, there is little room for wage growth.

a piece rate and another is offered a salary, one must ask why this is the case. Could it be that better workers are observed receiving piece rates while their less able counterparts are paid salaries? If so, any estimate of productivity differences will overstate the true effect of piece rates. Despite these obstacles, a number of recent papers have successfully addressed these problems.<sup>4</sup>

Lazear (1996) uses data from a windshield fitting company to estimate the change in performance that occurred when the firm introduced piece rates. A change in management resulted in the introduction of piece rates, initially in selected areas but eventually to all employees. He finds that productivity rose on the order of 35% from the introduction of piece rates. However, he shows that almost half the increase occurs from a selection effect, where the most able workers are attracted to piece rates, while the less able leave, again as predicted by the theory. Paarsch and Shearer (1996) use data on tree-planters in British Columbia where in some instances piece rates are used but in others there are fixed wages. Using a more structural approach than Lazear, they find incentive effects that account for between 6% and 35% increases in productivity due to the compensation scheme. Once again, they find evidence of the selection effects of piece rates, providing another warning about simply comparing the productivity of those on piece rates with those who are not. Fernie and Metcalf (1996) use data on the performance of British jockeys to illustrate that the use of bonuses attached to victories results in improved performance.<sup>5</sup> One of the most interesting discoveries of these recent papers has been the very large returns to pay-for-performance.

In most firms, it is almost impossible to obtain a comprehensive objective measure of a worker's performance. Kahn and Sherer (1990) proxy worker performance by performance evaluations provided by a superior. They find that managers with higher incentive provisions have

---

<sup>4</sup>It should be remembered that workers operate under implicit contracts, possibly in addition to explicit contracts. In the most prevalent form of implicit contract, poor performance will result in the worker being fired. Such implicit contracts, which are never observed, surely affect worker behavior. As a result, we should be aware that the studies in this section (and throughout the paper) can only estimate the marginal effect of the explicit contracts given an unobserved set of implicit contracts.

<sup>5</sup>Marschke (1996) studies the effect of incentive provision in the context of a federal bureaucracy, where states offer incentives to the providers of publicly funded job training for welfare recipients. He shows that the providers of training offer more appropriate skills when they are rewarded based on employment rates for the trainees.

higher subsequent performance levels than other managers.<sup>6</sup> Causality may be a concern here as there is a large literature illustrating that pay-for-performance can often *cause* high ratings, as supervisors realize that the cost of poor evaluations to workers is large.<sup>7</sup>

The performance of entire nations is sometimes attributed to the provision of incentives. Some recent work has addressed the effect of compensation in Japan and in Russia to understand the role of pay-for-performance contracts in explaining productivity. First, Jones and Kato (1995) use panel data on Japanese firms to estimate that the introduction of ESOP plans increases worker productivity by approximately 5%, though the full effects are only felt after about 4 years. It should be remembered here that this does not really provide much of a vindication of standard agency theory because in a large firm, ESOPs should have little effect as the marginal effect of effort on wages is negligible. Second, Barberis, Boycko, and Shleifer (1996) have addressed the effect of equity ownership for managers on the performance of privatized shops in Russia. Their results suggest that this form of incentive provision has had little effect, though selection issues remain a concern here.

Another line of research has considered the effect of nonlinearities in rewards. For example, suppose that a worker is rewarded with a salary unless he sells more than \$100 worth of output in a year, in which case he gets a bonus. Then agency considerations suggest that the behavior of the worker changes as he gets close to selling \$100. For example, we would expect the worker to have different incentives if he has sold \$90 by December 1, than if he has sold \$9. A number of papers have addressed the effect of these nonlinearities on behavior. Chevalier and Ellison (1995) consider their effect on the risk-taking behavior of mutual fund managers. They show that mutual fund managers face non-linear incentives because the 'top' mutual funds tend to attract a particularly large inflow of funds and managers are rewarded on fund size. As a result, those manager close to the 'top' have an incentive to take (inefficient) risks to gain such inflow. They find that those

---

<sup>6</sup>The identification strategy used here is that some plant locations offer different incentive packages than others.

<sup>7</sup> Abowd (1990) uses the event study methodology (where changes in stock prices reflect the importance of "news") to illustrate the effect of new compensation plans on firm value. See also Putterman (1990) for an application to data on Chinese communes.



managers who are found on the convex component of the reward schedule increase the riskiness of their portfolios, as predicted by agency theory.

Other attempts to identify the effects of nonlinearities in rewards have been made by estimating the impact of quotas on performance. Asch (1990) studies the behavior of Navy recruiters who are rewarded on the basis of a quota of recruits at the end of the calendar year. As they approach the end-of-year deadline, the average quality of recruits falls, illustrating harmful incentives induced by the contract offered. Similar evidence is provided by Healy (1985) on the willingness of executives to hide earnings if they are rewarded on the basis of thresholds. In particular, many executives are rewarded on company earnings only if they lie within a certain range. Above some level, rewards are fixed, while there is also a lower bound to rewards if earnings are particularly poor. This gives rise to an incentive for executives to hide earnings until the following year if they are not within the range that generates returns. (This behavior is known among salesforce workers as sandbagging.) Healy's empirical evidence supports this hypothesis. Finally, Oyer (1995) finds similar behavior by salesforce workers and argues that business seasonality is likely to be partly generated by such incentives.<sup>8</sup>

Two remaining areas of incentive theory that have attracted attention are tournament theory and the behavior of teams. Following Lazear and Rosen (1981), many authors have considered competition between workers through the lens of tournaments, where agents compete for a fixed set of prizes, such as promotion. Tournament theory carries the following two testable implications: (i) larger marginal prizes should increase performance, and (ii) those who are behind (ahead) should take more (fewer) risks. Empirical evidence (largely from sports contests) shows that as the spread in prizes between ranks increases, performance improves. Ehrenberg and Bognanno (1990) find that golfers' performances appear to vary positively with the marginal return to effort, proxied by how prize money is allocated among finishers of different ranks. Becker and Huselid (1992) find similar behavior among professional auto drivers, but they also endorse another prediction of tournament theory; namely, that large prizes can give rise to dysfunctional behavior, as a greater return to a high placement results in more risky driving. Similar results have been found for the behavior of farmers

---

<sup>8</sup>For related work on the behavior of the providers of publicly funded job training schemes, see Courty and Marshke (1995).

raising chickens (who are rewarded relative to their peers by the broiler companies) in Knoeber (1989) and Knoeber and Thurman (1994). Knoeber and Thurman also provide evidence on risk taking by the less able in these chicken-breeding tournaments.<sup>9</sup>

A particular area of incentive provision that remains largely untested is the behavior of individuals within teams. Some economists warn against the incentives effects of teams, as free-riding is likely to harm performance. Others claim that peer pressure is likely to mitigate these problems. Gaynor and Pauly (1990) study productivity in medical practices of different size to illustrate the importance of free riding. The doctors were asked about their willingness to accept risky income, which was used as an instrument to predict the size of the practice.<sup>10</sup> Gaynor and Pauly illustrate how performance falls as medical practice groups get larger, endorsing the free-rider problem. Newhouse (1973) also addresses the effect of group based incentives in medical practices and shows that (i) overhead costs were higher in practices that share their costs, and (ii) those doctors who share profits work less. Bailey (1970) finds similar results with data on medical practices, while Leibowitz and Tollison (1980) find evidence that cost control is poorer in large legal practices than in small practices. Each of these papers endorses the pre-eminence of free-riding over any peer effects. On the other hand, Weiss (1987) is to my knowledge the only illustration of the effect of peer pressure in teams. He uses data from a manufacturing company to show that the introduction of piece rates tends to increase the performance of the least able but decreases the performance of the most able, as workers learn to conform to a norm. Additionally, he shows that the piece rate system increases turnover among the least able and the most able, but not the average worker. A reasonable interpretation of this is that the talented feel under-rewarded and the least able feel excess pressure from the norms. In summary, then, the effect of incentives in teams seems to be largely dominated by free-rider effects, so that any benefits to teams must be largely

---

<sup>9</sup>Using Australian data, Drago and Garvey (1994) verify the hypothesis that greater returns to promotion will result in less cooperative behavior by workers. This accords with theoretical work by Lazear (1989) and Holmstrom and Milgrom (1992). Finally, Main et al. (1993) endorse an implication of tournament theory by showing that the reward for becoming CEO is greater if there are more possible candidates for the job at the next lowest level.

<sup>10</sup>Those who are less risk averse will work in smaller practices, as they are more willing to give up divestification to avoid free rider problems.

technological rather than based on incentives.

## *2. The Existence of Contracts*

The data requirements for testing whether incentives matter are stringent. As a result, a second approach to testing agency theory has been to consider whether observed contracts accord with available theory.

### *a. Pay-for-Performance Contracts*

The early literature on agency contracting has emphasized the trade-off of risk and incentives. From that perspective, incentive provision is muted by the desire to provide agents with a relatively smooth income stream. As a result, we would expect pay-for-performance to be lower in cases where either the environment is more risky or the agent is more risk averse. By contrast, those instances where the return to effort is large will imply higher pay-for-performance. More recent literature (Holmstrom and Milgrom, 1992) has also emphasized the possibility that agents are likely to substitute between activities if offered piece rates. The typical example of this trade-off, referred to as multi-tasking, is where an employee ignores quality considerations to maximize the quantity of output he produces under a piece rate.

Two approaches have been taken in the literature on estimating pay-for-performance, which for the most part has either been on executives or salesforce workers. First, Murphy (1986), Jensen and Murphy (1990) and Kaplan (1994) have estimated the return to executives from improving various measure of performance, such as earnings, the stock price and so on. On the basis of these estimates, the authors have drawn conclusions about the effectiveness of corporate governance. These papers have one potentially important drawback; it is extremely difficult to identify the “right” level of incentives predicted by the theory since many of the relevant variables (such as the cost of effort) are unobservable. Consequently, a second way of understanding the relevance of the theory is to consider whether pay-for-performance varies with the parameters identified above. Garen (1994), Shaefer (1994), Coughlin and Narasimhan (1992), John and Weitz (1989) and Kawasaki and McMillan (1987) provide evidence suggesting that contracts operate in the predicted way, though the results are rarely resounding.

Agency theory also predicts that when workers face common shocks to productivity, it is efficient to compare them to one another when deciding on rewards. In this setting, workers are rewarded when those similar do badly and punished when similar workers do well. This serves to filter out common risk. Using data on executives, Antle and Smith (1986) find little evidence of such relative performance evaluation. By contrast, Gibbons and Murphy (1990) find that firms tend to compare their senior managers' performance to stock market performance when determining rewards. Somewhat surprisingly, they are more likely to use the stock market as the relevant comparison than the performance of competitors.

It should be obvious that in some instance it is not necessary to provide workers with explicit incentives when they can develop reputations, if those reputations affect their wages. For instance, baseball players would continue to exert effort without rewards explicitly tied to measures of performance because there is a market for players. An important consideration for many firms is to optimally combine these implicit contracts with more explicit contracts, such as stock ownership. Gibbons and Murphy (1992) address this problem by considering how managerial tenure affects the combinations of implicit and explicit contracts. In particular, does agency contracting for executives seem to reflect such reputational concerns? They note that such reputational concerns are likely to be more effective when executives are new to the job, both because little is known about them and because they potentially have a long time in the job to garner the fruits of a reputation. On the other hand, as they come close to retirement, they have less concern for reputation.<sup>11</sup> An implication of agency theory is then that managers close to retirement should be offered contracts with steeper incentive provisions, where rewards are directly tied to performance, as reputational concerns are not sufficient to provide incentives. Gibbons and Murphy find support for this proposition in their data, and more recent work by Gompers and Lerner (1994) on venture capitalists finds similar evidence.

Some recent theoretical contributions to the compensation literature stress that incentives

---

<sup>11</sup>This arises because current performance is less informative about ability later in a career than when the worker begins, and because workers have little time left in which to get the returns to a good reputation. Consequently, poor performance later in the career will be less costly to the worker than earlier. Chevalier and Ellison (1996) show that among mutual fund managers, the marginal effect of poor performance on the propensity for the managers to be fired is greater for younger than older managers, as predicted by the theory.

are likely to be constrained by the fact that they will result in inefficient rent-seeking behavior: workers will waste valuable time and resources attempting to persuade their superiors of their talents rather than producing (Milgrom and Roberts, 1990, Prendergast and Topel, 1996). An implication of this literature is that firms may use institutional rules that constrain supervisors from rewarding those employees who most able. Many authors have examined such bureaucracy in the employment relation, where many decisions are made by rule rather than by discretion. For example, Freeman and Medoff (1984) highlight the importance of seniority restrictions not only in layoff decisions but also in determining promotion. Similar data on bureaucratic restrictions in firms are provided by Spilerman (1986), who examines how firms doing relatively similar things (e.g., policemen in Chicago vs. policemen in Philadelphia) often bureaucratically specify very different wage scales while leaving supervisors almost no room to maneuver.<sup>12</sup>

Agency theory focuses extensively on the effects of monitoring on the provision of contracts. Firms spend considerable time and resources identifying how best to monitor workers, but at an empirical level economists have done little to understand the costs and benefits of various forms of evaluation. Some workers are monitored on the basis of counted output while others' performance is measured in a subjective fashion by a boss. This typically gives rise to certain problems, such as reluctance to offer bad evaluations (Larkey and Caulkins, 1992), or accusations of favoritism (Bretz and Milkovitch, 1989). Certain types of workers are monitored frequently while others are monitored at most annually. Many individuals are monitored on their inputs, while in other occupations workers can come and go as they please. With the exception of Brown (1990) and Bishop (1987), there has been little descriptive work that could identify how evaluations occur. Work needs to be done here in devising a simple taxonomy of monitoring arrangements, because this would provide useful information on how incentives are provided to workers who do not operate under explicit incentives.

### *b. Deferred Compensation*

---

<sup>12</sup>The existing research on such bureaucratic constraints is mostly based on blue-collar work, often in unionized settings. It would be useful to know more about their prevalence. For instance, are such seniority restrictions less common the farther one ascends in the hierarchy?

A question that has received considerable attention from empirical researchers has been whether firms overpay older workers and underpay younger workers, which has been suggested is an optimal way of providing incentives (Lazear (1981)) and reducing turnover. These tests suffer from one major difficulty; observing productivity. Indeed, there is little need for seniority wages in situations where productivity is easily observed; it is a more potent instrument where output is difficult to measure or only becomes observed after some time. Hence, the only cases where this policy will be used is where output can't be observed, making tests difficult. Despite this, a number of ingenious ways of identifying productivity have been considered.

First, Medoff and Abraham (1981) use performance evaluations as a proxy for worker performance. In particular, they note that the wages of older workers are higher than their younger counterparts, despite equivalent performance ratings across age cohorts. To the extent that performance evaluations measure productivity (rather than, say, productivity relative to age-dependent expectations) this constitutes evidence in favor of deferred compensation.

Another way of estimating productivity would be to find a group of workers who do the same job as the workers in question but for whom there is no opportunity for backloading of wages. With this in mind, Lazear and Moore (1986) consider whether the wages of those in self-employment are as steeply sloped as those who work for organizations. Assuming that the jobs of the self-employed and employed are similar, any difference in slope between the two groups could be attributable to the desire of the firm to backload wages. The identifying assumption here is that the slope of the productivity profile is similar for the two types of workers. They find that the wage profiles of the self-employed are less steeply sloped than those of the non self-employed, which is consistent with deferred compensation being used.

The idea behind backloading wages is that workers pay into a trust fund when they are young, which is returned later in life. This logic holds only if the worker has been with the firm for some time. For a worker who joins a firm late in life, opportunities for backloading are severely limited. Using this idea, Kotlikoff and Gokhale (1992) proxy productivity within firms by the wages of newcomers. For example, consider the wage of a worker who is in her final year of employment and who joined a firm in that year. Her wage should be a reasonable measure of her productivity. If matching issues and specific human capital are not important then this wage should also be a good

measure of the productivity of a worker of that age who has been employed there for a longer time. Using this methodology, they compare the wages of newcomers and similar workers with more tenure and find that (i) the wages of office workers appear to be backloaded and (ii) those of salespeople are not. It should be remembered however that the identification restrictions (little specific human capital and little selection in late hires) are strong here.<sup>13</sup>

Alternative measures of identifying the effect of seniority on pay come from directly considering rules in firms where wages or promotions increase with seniority independent of any productivity issues. As mentioned above, Freeman and Medoff (1984) and Spilerman (1986) illustrate the prevalence of rules relating tenure and wages independent of productivity.<sup>14</sup>

### *c: The Importance of Jobs*

The standard labor problem cares little about the notion of a job, but it is clear that in many cases the primary route for advancement within a firm is through changing jobs, or at least through changing job titles. Should we care about this correlation? Isn't it enough to know the reduced form mapping given by earnings equations? There are a number of reasons for understanding the role of tasks and job assignments. First, researchers interested in discrimination often describe the mechanism by which women and minorities are restricted in the labor market as a "glass ceiling", where certain jobs are restricted to favored groups. Alternatively, if the sole route to career advancement is through changing jobs, there may be inefficiencies caused by certain jobs being

---

<sup>13</sup>Furthermore, an auxiliary implication of the deferred compensation model is that mandatory retirement is also likely to be used in conjunction with deferred compensation, since overpaid older workers will be reluctant to leave. This has been addressed by Hutchens (1986), who shows that the existence of mandatory retirement can be predicted by the steepness of worker wage profiles.

<sup>14</sup>As with many of the studies in this review, there is an alternative interpretation of the data. Some authors have argued that wages rise with seniority simply because workers like wages increasing the longer they stay on the job rather than that firms use this strategy to provide incentives. For example, Loewenstein and Sicherman (1991) use survey data that illustrate that individuals seem to prefer such wage profiles, even when net present value considerations suggest otherwise. Another related effort is Frank and Hutchens (1993) who consider two occupations (bus driver and airline pilot) where productivity "should be" relatively flat after initial training and where monitoring concerns are not deemed to be important. They show that the wages of airline pilots and bus drivers continue to increase long after agency and productivity growth issues would suggest is warranted. They attribute this increase in wages to worker preferences.

"dead end jobs". Similarly, if a particular individual has poor promotion prospects, he is likely to have few incentives in a world where wages are largely attached to jobs (Gibbs, 1995, Gibbs and Hendricks, 1996). Finally, jobs play a central role in tournament theory so an understanding of the role of job changes in career advancement may also cast light on how firms provide incentives.

Many personnel files include data on wages and the history of jobs that an individual previously held within the firm, so that it is sometimes possible to identify the relationship between job changes and the evolution of wages. For example, using data from a single company Lazear (1991) finds that those workers who have experienced promotion in the past earn 21% higher wages than those individuals who have not. Baker, Gibbs and Holmstrom (1994a) find that the immediate premium on promotion in the firm they study is on average 6% but that this difference underestimates (by a factor of about 4) the difference in average wages across levels, as subsequent pay increases are higher for those promoted than for those passed over.<sup>15</sup> Furthermore, there is considerable overlap in wages across adjacent (in the hierarchical sense) jobs, so that some workers in "lower" jobs are earning more than others in "higher" jobs. This observation is important as it suggests that firms use many means of providing incentives, not just the prospect of promotion, because there is considerable variation in wages within job grades.

One of the most common bureaucratic rules within firms is that each job classification has a wage range that cannot be violated. For example, a job may have 6 grades and when a worker has reached grade 6, there may be little that the firm can do to increase the worker's wage other than to promote her to a different job. This phenomenon, known as "topping out", appears to be a concern of practitioners but has played little role in economic work on compensation. Some evidence on this phenomenon is provided in Baker, Gibbs, and Holmstrom (1994a), who show that such limits seem to constrain wage growth. Gibbs and Hendricks (1996) illustrate that firms do not seem to provide other incentives for those workers. Spilerman and Petersen (1993) show that firms can partly overcome this problem by transferring workers to jobs that do not entail such constraints. They also show that such transfers are an imperfect mechanism and that those workers who are at the top of their wage grades are generally impeded from future increases. Somewhat surprisingly, they find

---

<sup>15</sup>Groshen (1991) also addresses the importance of job classifications in wage determination.



no evidence that exits from the firm are accelerated by being at the top of a wage grade.<sup>16</sup>

Doeringer and Piore (1971) argue that one of the defining characteristics of an internal labor market is limited ports of entry, where the most senior jobs are filled by insiders. In other words, working one's way through the system is an integral part of a career. However, the small amount of available data from personnel files on ports of entry (Lazear, 1991, Baker, Gibbs and Holmstrom, 1994b) show little evidence of this; instead there is considerable hiring from outside at all levels of the firm. Further work on this issue seems necessary. For example, what are the characteristics of those jobs filled internally? Are they predominantly low-skill jobs?

#### *d. Efficiency wages*

Efficiency wage theory argues that workers will be offered rents in order to increase productivity. Some work testing the validity of these theories has revolved around studying inter-industry wage differentials using large data sets to measure whether workers are earning rents in high wage industries (Krueger and Summers (1988)). An alternative test can be carried out using firm level data, operating on the premise that firms will see supervision and wage premia as substitutes for inducing effort. In other words, since firms can induce effort either by wages or by monitoring, these instruments should be substitutes. Data testing this hypothesis have been analyzed by Leonard (1987), Groshen and Krueger (1990), and Cappelli and Chauvin (1991) with mixed results.<sup>17</sup>

---

<sup>16</sup>Lazear (1991) also points to the existence of considerable differences in promotion prospects across different jobs.

<sup>17</sup>It should not be surprising that this work has not provided a clear result, as it is not obvious at a theoretical level whether supervision and wages are complements or substitutes. More specifically, would we expect supervisors and rents to be complements or substitutes in the data? This seems to depend critically on the source of variation across firms. On the one hand, if the source of variation across companies is the cost of supervisors, then the two instruments probably will act as substitutes in the data where the high cost supervisor firms will use more wages and less supervisors to get effort exertion. On the other hand, if the variation across firms is primarily through the value of effort exertion, then those firms that want more effort will probably use more of both instruments relative to those that do not value so much effort, so that supervision and wages will be complements in the data. Therefore, this does not seem as powerful a test as one might like.

### ***C: Learning***

The talents of workers are rarely known for sure when they join a firm; they gradually become revealed as the worker spends time there. Recent theoretical work has argued for the importance of learning about worker talent as an explanation of wage dynamics in the labor market. See for example, Holmstrom (1982). The starkest form of learning, called pure learning by Farber and Gibbons (1996), assumes that the productivity of an individual is determined by a time-invariant characteristic, ability, where ability is gradually revealed over time. In this world, perceptions of ability evolve according to a random walk.

Suppose that markets clear contemporaneously. Then the evolution of wages will map the arrival of information about the worker's talent. An immediate implication is that the variance of wages for a cohort of similar workers will increase over time as workers who were initially similar are revealed to be dissimilar.<sup>18</sup> Furthermore, wages in this environment will follow a martingale, where wages follow a random walk, as the law of iterated expectations implies that future innovations to wages cannot be predicted by previous innovations.<sup>19</sup>

This is a very stark form of learning as it allows no efficiency value to information on the worker's ability, and suggests that there are few returns to allocating workers to suitable tasks or to allocating additional training to the most able. However, firms often devote considerable resources to identifying talent. This ability to assign workers on the basis of more precise information implies that wages no longer follow a martingale but instead follow a submartingale, where the expectation of next year's wage, given this year's information, exceeds this year's wage. To phrase this in more familiar terms, information is useful as workers can be better sorted to jobs that match their talents.

The role of learning in firms has often been analyzed by considering the serial correlation

---

<sup>18</sup>See for example, data in Spurr and Barber (1994) on the evolution of baseball salaries reflecting the revelation of information on talent.

<sup>19</sup>A further implication of this model is that the value of any attribute the worker holds when he joins the firm (such as race or education) will not change over time in an econometric regression predicting wages. See Farber and Gibbons (1996) for details.

of changes in rewards. There have been studies on serial correlation in rewards using both personnel files and larger data sets. Many studies using personnel files find evidence of serial correlation in promotions; those who are promoted quickly are more likely to be promoted again than the slow movers (Rosenbaum (1979), Bruderl et al. (1991), Spilerman and Peterson (1993), Baker, Gibbs, and Holmstrom (1994a), and Spilerman and Ishida (1994)). Baker, Gibbs and Holmstrom find similar evidence on wage changes (and residuals). However, the results from the more aggregate studies are mixed. For instance, Lillard and Weiss (1979), and Card and Hyslop (1995) find evidence of such serial correlation by observing a person-specific growth rate in wages. Gibbons and Farber (1996) also reject the assumption that wages can be modelled as a martingale, though not convincingly. On the other hand, Abowd and Card (1989), Topel (1991) and Topel and Ward (1992) find little evidence of correlation in wage changes.

Some literature on human capital can also be used to cast light on this issue. Correlation in wage changes or promotion would be expected if the more able were trained more intensively throughout their career. Barron, Black & Loewenstein (1989), and Ashenfelter and LaLonde (1995) illustrate such a complementarity between observed ability and on-the-job training. For example, college graduates get more training than high school graduates who in turn get more training than high school dropouts. As a result, we would expect the wages of the more talented workers to increase at a more rapid rate than those of their less able counterparts.

It is difficult to know how to interpret these results. The firm-level studies suggest that talent is identified and talented workers are treated differently than their less able counterparts, either through extra training or more difficult assignments. At an intuitive level, this result is not surprising. More surprising is the lack of support for the idea in the aggregate data, even when restricting attention to workers who do not change firms, as in Topel (1991) and Topel and Ward (1992). One possible reason for this, suggested by Gibbons (1996), is that such person-specific growth rates are evident only in particularly skilled occupations, but this is yet to be tested.

One value of theoretical work should be to allow researchers to distinguish among various competing theories. A prime example of such an identification problem is the ability to distinguish between human capital theory and learning as an explanation for wage dynamics. In particular, consider the problem of distinguishing between a model that views wages as evolving through learning about worker talents and another that identifies wage changes as being caused by human

capital evolving throughout a worker's career. Suppose that there is a random component to skills, where the value of skills moves about each year subject to upward drift caused by skill collection. What predictions arise from the learning model? First, the variance of wages will increase over time, and, second, wages will follow a submartingale (if workers can be assigned to jobs based on differing talents). Can this theory be distinguished from a model of human capital acquisition, where the value of a worker's skills varies over time? A number of possible routes can be followed. First, Farber and Gibbons (1996) use a measure of talent that is available to the econometrician but not available to the firm to address whether wages are increasingly correlated with this measure over time.

This is a prediction of the learning model as wages should increasingly track ability over time, and the ability measure is by assumption privately observed by the econometrician. Remember that two necessary conditions for this to operate as a valid test of learning over purely human capital are (i) that the worker cannot credibly transmit this information to the firm, and (ii) that the innovations to skills are not correlated with this measure of ability (so that the human capital model has different predictions than the learning model). Using this methodology, Farber and Gibbons use aptitude test scores that suggest the importance of learning in the workplace.

A final route that might be considered is to compare the relationship between wage innovations and tenure. A plausible restriction on the learning model is that the value of information is greatest at the beginning of a worker's career, and that ultimately new information becomes of little value. It is not as clear why a human capital model with random shocks to productivity should have this feature, particularly for negative shocks.<sup>20</sup> As a result, it may be possible to identify the effects of learning in the workplace by considering the innovations of old workers relative to newcomers who are otherwise observationally equivalent. See Baker, Gibbs and Holmstrom (1994b) for details.<sup>21</sup>

---

<sup>20</sup>In most occupations, there is more opportunity to learn new skills when the worker is new to a job. However, there is little reason to expect that depreciation in skills should have this feature.

<sup>21</sup>A final career issue studied by sociologists is how quickly individuals become differentiated from their peers. Is it the case that within a given cohort of entrants, firms identify and reward their high performers soon after they arrive, or do they try to minimize differentiation within a cohort? Anecdotally it appears that

## *Learning and Insurance*

Learning involves the revelation of information which may reduce the wages of workers. However, risk-averse workers may demand that wages be insured against variation in the price of their services, say through an economic downturn. One strategy to understanding the importance of such insurance would be to compare real wage changes with changes in productivity. This suffers from the difficulty in measuring productivity.

A second approach, taken by Beaudry and Di Nardo (1991) and Baker, Gibbs, and Holmstrom (1994a), has been to address the effect of starting wages on current wages. Consider a world where workers are risk averse and write long-term contracts when they join a firm. The optimal risk-sharing contract smooths consumption across time periods. Therefore, economic conditions when the worker joins the firm will predict future wages: those who join the firm when conditions are good will continue to get high wages in future years, even if conditions in those years are poor. Beaudry and Di Nardo (1991) show that a worker's wage can be predicted by his entry level (market) wage, even after controlling for the entry wages of newcomers. Even if the wages of entry level workers fall, the wages of existing workers will not change much. If the newcomers are similar in quality to the older workers, this evidence suggests an insurance motive for a deviation from marginal product.

Baker, Gibbs and Holmstrom (1994b) use firm level data to illustrate the same phenomenon, and can additionally show that despite differences in wages across entry cohorts, there is no difference in their promotion performance so that it does not appear that these differences reflect talent differences. Therefore, there appears to be a contractual mechanism between existing workers and employers that does more than simply equate marginal revenue with the wage.

Another form of insurance that workers may desire is over their ability. When workers join

---

firms are often reluctant to differentiate among workers, perhaps for fear of discouraging workers who are "left behind". This aspect of career development has been addressed recently by Spilerman and Ishida (1994) using Japanese data. They show that for the first ten years of a worker's career there is little differentiation, with most workers moving up the corporate hierarchy at roughly the same rate (only the very low quality are not promoted). However, after 10-15 years there is much more noticeable differentiation of workers.

a firm, there is typically uncertainty about their talents. In some instances, workers will be worse than initially anticipated. Once again, workers may demand insurance against such permanent changes in their human capital. This demand for insurance must be balanced against the possibility of the worker leaving to get a better job. Harris and Holmstrom (1982) illustrate that the optimal solution to this problem is to offer workers a real wage that increases if the perception of the worker improves but cannot be reduced. A clever test of this model has been developed by Chiappori et al. (1996). They compare workers who started their careers similarly but whose paths diverged such that one employee had rapid wage increases followed by flat wages, while another had a slow beginning but has now caught up to the first worker. An implication of Harris and Holmstrom is that the latter worker will fare better in future. The reason for this is that the latter's wage is increasing so he must at least have been better than his last year's impression. The most recent performance of the other worker was poor and so (in finance parlance) his option is likely to be 'out of the money', in that marginal increases in his performance will have no effect on future wages. Chiappori, Salanie and Valentin find this pattern in the data.

### *Learning and Turnover*

Learning also plays a central role in the understanding of worker turnover, though in this case workers and employers typically learn about the aptitude of workers with particular employers. Matching theory provides another reason for wages increasing with tenure - those with long tenure will have found better matches than those who have recently arrived in jobs. Accordingly, available empirical work has focused on the implications of tenure and demographic characteristics for job changing. See Farber (1994), Sicherman (1995), and Mincer (1986). One way of identifying the effect of matching is to identify whether turnover predominantly comes from those who appear to be faring poorly within firms, indicating that they are poorly matched. Little work has been done on turnover using personnel files, but available evidence suggests little evidence of systematically more movement among the less able than among those whose performance is better than expected (Baker, Gibbs, and Holmstrom 1994a).

### **III: Identification and Data Issues**

## ***A: Identification***

The ultimate objective of empirical work on incentives should be to find out why firms use the compensation policies they do, and to determine the impact of such policies on productivity or welfare. This involves two important identification problems. First, there is a need to develop empirical tests where productivity measures are related to compensation policies, where the source of the variation in such policies has been accounted for. This is the standard *empirical identification* problem. However, in many instances available theory has not yet been sufficiently developed to distinguish between different plausible theories. The typical theoretical paper offers few empirical predictions: those that do so often offer suggestions about the data that are consistent with the theory but unfortunately as yet we have few ways of distinguishing *between* the theories, which I think is necessary to fully develop empirical testing of compensation policies.

### ***i. Empirical Identification***

Selection problems pervade economic analysis, as individuals frequently choose the treatments that they undergo. In studies of the employment relation, a two-sided selection problem clouds identification of the effects of contracts. First, employers choose the contract that will be offered to workers; quite possibly different workers are offered different contracts. Second, workers are not bonded to their employers, and so only certain workers may accept a given contract. Controlling for this problem is difficult, but without addressing it, there is little hope that the effects of contracts can be truly identified.

Both empirical and theoretical work emphasizes the importance of such selection effects. For instance, Lazear (1996) estimates that approximately half of the effect of piece rates on productivity can be attributed to more able workers being assigned to such contracts. Paarsch and Shearer (1996) find similar results from their study on Canadian tree-planters. Given such selection issues, it is important to control appropriately for their effects in studying compensations. Various

ingenious strategies have been followed to control for such selection.<sup>22</sup> Such identification assumptions play a particularly important role here because in many cases such imprecise information is available on other relevant data. For instance, in many studies either the contracts offered have to be inferred (from, say, the relation between performance evaluations and wages, as in Kahn and Shearer (1990)) or the performance measures of the worker's performance are imprecise (e.g., the stock price being a measure of a CEO's performance). There is little room for manoeuvre if the instruments are weak. In some cases the weakness of the basic data has made some of the identification restrictions less reliable than we would like.

---

<sup>22</sup> Among those used are :

*1. Variation in risk tolerance*

Gaynor and Pauly (1990) use survey evidence on doctors that asks them the importance of smoothness in their income. This variable is then used to predict contracts offered and their impact on the performance of medical practices. If risk tolerance is uncorrelated with ability, and the instrument has reasonable power in predicting contract choices, this would be a reasonable instrument.

*2. Variation across location*

Kahn and Sherer (1990), use variation across positions and locations in the firm in the sensitivity of pay for performance. Lazear (1996) uses the fact that contracts differ across plants as a means of identifying the effect of incentives. He uses worker fixed-effects, so this identification strategy is reasonable so long as other (unobserved) management changes did not also differentially affect productivity in those locations.

*3. Newcomers to the firm*

In any situation where workers are compensated over the long term, we would expect to observe a difference in the way newcomers are paid relative to observationally equivalent workers with long tenure in the firm. This approach has been taken by Kotlikoff and Gokhale (1992), Beaudry and DiNardo (1990) and Baker, Gibbs, and Holmstrom (1994b). One attraction of Baker, Gibbs and Holmstrom is that they illustrate that the quality of workers is similar across the various cohorts, thus alleviating fears of selection effects caused by ability differences across cohorts.

*4. Age or Tenure*

Age and tenure constitute a legitimate source of identification in a couple of settings. First, models that rely on the importance of reputation typically depend on the worker's horizon, which obviously depends on how long they will work before retirement. Gibbons and Murphy (1992) use such theoretical constraints based on tenure to identify variation in the contracts offered to workers. So long as worker tenure is not correlated with other confounding effects, such as that the marginal return to effort is higher for older workers, this is a useful source of variation in the data that can be exploited. Tenure and age also play an important role in the identification of learning models, as plausible restrictions on learning models will imply that most learning about workers occurs early in the worker's career. This feature has been exploited in Farber and Gibbons (1996), Glaeser (1992), and Baker, Gibbs and Holmstrom (1994b).



## *ii. Theoretical identification*

Perhaps the primary objective of empirical research on organizations should be to understand why firms treat workers as they do. This requires that the available theoretical work can be used explain the data. Two approaches to making the theory data-friendly can be followed. First, theoretical work can predict certain outcomes in the data. Such tests usually tell us that certain outcomes are compatible with the theory. For instance, to use the example earlier, incentive theory suggests that in some instances, firms will backload wages. Then a failure to observe backloaded wages would negate the relevance of this theory. However, if we see that wages are indeed backloaded, this does not necessarily imply that firms do so for the reason posited; it could be for any other reason. A second approach, which is much more difficult, is to offer suggestions about how the data could help to distinguish among a number of plausible theories. In other words, offer a plausible alternative hypothesis against which to compare theoretical predictions. It is not the purpose of the paper to provide a menu of ways in which this could be done, but the following examples may be suggestive.<sup>23</sup>

### *a. Are Wages Backloaded?*

Assume that a researcher finds evidence that firms overpay older workers but underpay younger workers, and would like to interpret her results. One interpretation is that firms do so because they find this the optimal way to provide incentives to workers. Another interpretation would be that they do so to offer a deterrent to quitting early, in which case firms will incur training or hiring costs. Finally, the data could simply reflect a preference among workers that their wages grow as the age, say, as a way of forced saving.

As yet, researchers have not tried to disentangle these competing hypotheses. However, a deeper look at the theories may help us to make progress. Backloaded wages are likely to be a

---

<sup>23</sup>An alternative approach to designing theories that carefully distinguish among plausible alternatives is to provide multiple predictions from a given theory. The idea here is that the combination of predictions is unlikely to replicate any other theory. See Gibbons and Waldman (1996) for such an approach.

desirable means of inducing incentives when output is hard to observe, where it may take some time to determine performance. In cases where performance measures are easily available, there should be little need for such measures: instead, straight piece rates are likely to dominate. Next consider the interpretation of the data that firms wish to backload wages to induce workers not to quit. Such inducements are likely to be greatest when firms pay significant training or turnover costs. As a result, it may be possible to disentangle these theories by considering whether the extent of backloading varies by occupation. Those occupations where output is hard to observe (or where training is intensive) are more likely to be offered backloaded wages than are other occupations if the incentive (or turnover) stories are true, which is unlikely to be the case if workers simply prefer wages that rise with age.<sup>24</sup>

*b. The Return to Promotion*

Wages rise as workers ascend a hierarchy. This is hardly surprising: more interesting is that the returns to promotion increase as one moves up the ranks of an organization. Hence, the increase in wages on becoming CEO is larger than the increase to become a senior executive and so on. There are a number of possible reasons why firms may choose to skew wages in this way. One is that workers are sorted to jobs in the basis of their talents (Rosen, 1982), where the most able affect the productivity of many others, and so their marginal product in those jobs is large. With this perspective, wage increases are simply a reflection of marginal product. However, tournament theory suggests that firms may choose such skewed returns as a means of providing incentives (Rosen, 1986). A useful analogy is a tennis tournament. Consider the incentives of a player in the first round of a tournament. His return from winning the game is not only the prize money from being a first-round winner, but also the option associated with the possibility of winning future rounds. This implies that there is a reason for the organizers of the tennis tournament to increase

---

<sup>24</sup>Kotlikoff and Gokhale (1992) consider a firm including both office workers and salesforce workers. Measurement of performance is easier with salesforce workers, who are typically rewarded by piece rates. Kotlikoff and Gokhale find that backloading of wages occurs only for the office workers. This evidence suggests incentive concerns (or possible turnover issues if office workers have more training than salesforce workers) rather than simply preferences for wages that increase with age, as there would be little reason for such preferences to be specific to office workers.

prizes in the later rounds, providing incentives not only in the later rounds but also in the earlier rounds through the increased value of the option. Similar logic holds within firms, where the return to becoming a senior manager may act as an inducement not just to middle managers but also to those lower in the organization who believe they ultimately have a chance of becoming a senior manager.

Recent work on tournament theory, such as Eriksson (1996), has argued that increasing returns to promotion across ranks in a hierarchy constitutes evidence in favor of tournament theory. At one level, this is of course true, as a failure to find this would be a direct contradiction. However, it fails to distinguish tournament theory from the plausible alternative described above. As a result, it may be necessary once again to delve somewhat deeper to better understand the motivation of firms. One plausible way to do this is to directly estimate the value of the option that underlies the tennis tournament analogy. In other words, how much should workers value the prospect of future promotions? This is not a conceptually difficult exercise to carry out as future promotion prospects and returns can be estimated. By estimating this option value, we can then determine whether the observed differences in wages across ranks correspond closely to the value of this option. If they don't, another explanation seems more plausible.

### *c Learning and Human Capital*

Wages typically rise as workers gain experience in the labor market. As described in the previous section, this could be caused by workers collecting more skills or because information is learned about workers which improves matching. Distinguishing between these two competing explanations has been the focus of recent work by Gibbons and Farber (1996) and Baker, Gibbs and Holmstrom (1994a) and has been an area where recent theory has been successful at providing a means of potentially distinguishing between the two theories. Two competing theories about wage dynamics are that (i) the value of a worker's skills varies over time, and (ii) information is arriving on worker talents which allows better assignment of the worker to jobs. Either of these theories would predict wages that increase with tenure. However, the value of information on a worker is likely to be greatest at the beginning of a worker's career (or when he starts a new job); ultimately new information becomes of little value. It is not as clear why a human capital model with random shocks to productivity should have this feature, particularly for negative shocks. Baker, Gibbs and

Holmstrom (1994a, 1994b) use this temporal dependence to argue for the importance of learning in explaining wage dynamics.

### ***B: Data Needs***

Tests of theories of compensation have been highly constrained by data limitations. To understand the effect of incentives on productivity, at the very least the researcher needs data on some reliable measure of output and the contracts under which workers operate. Given the difficulty in getting reliable measures of performance on workers, it is not surprising that much of the literature on agency contracting has been concerned with estimating the existence of contracts compatible with the theory, rather than their effects. It is also not surprising that most work on agency contracting has been done on either salesforce workers or CEOs, for whom contracts are most likely to be available.

The greatest challenge to those studying the effect of compensation on performance is to understand how wages are determined for the typical worker who is not on a piece rate, whose output is subjectively determined by his boss, and for whom there are little data on the contractual environment. I would argue that this covers the majority of workers in the economy, yet we know little about the contractual environment in which they work. It is in this context that there is considerable enthusiasm about recent work on personnel files of the type studied by Lazear (1991), Baker, Gibbs and Holmstrom (1994a,1994b) and Gibbs and Hendricks (1996). I believe that a great deal can be learned about compensation from such data archives. They may be even more useful as a means of describing the work lives and careers of workers than of either identifying how workers respond to incentives or understanding why firms carry out observed policies. More specifically, such personnel files typically contain voluminous information about jobs, wages and benefits, and plenty of demographic data, but are bereft of information about contracts or performance. As a result, they may ultimately be more useful as a description of careers than anything else. While this is very valuable, a need for other types of data remains.<sup>25</sup>

---

<sup>25</sup>It would be useful to identify areas in which such data files can dominate the larger data sets commonly used by labor economists. What is it exactly about these data sets that distinguishes them from larger data sets

Huge advances in our understanding could be made by a concerted effort to collect data on contracts. By and large, data on contracts are scant, with the exception of some work on executives and sports players. However, my sense is that the marginal return to collecting such data would be large, and some of the most interesting papers on compensation (Knoeber and Thurman (1994), Chevalier and Ellison (1995), Lazear (1996), Paarsch and Shearer (1996), and Metcalf and Fernie (1996) ) have given pre-eminence to collecting such data. Without data on contracts, it is close to impossible to identify how incentives affect behavior. Therefore, I believe that perhaps the largest holes in our knowledge about the provision of incentives arise from ignorance on how workers are rewarded.

Obviously, only a limited number of workers are offered explicit contracts that relate wages to performance measures. The majority of workers operate in shadier territory where contracts are implicit, with the promise of a wage increase or promotion based on good performance. As I mentioned above, one data limitation for understanding such workers is that there is little information on how workers are evaluated. Having such information may be a second-best way of understanding the contractual environment in which they operate. This is not an easy task, as illustrated by the dearth of papers that seriously consider performance evaluation (Brown, 1990, is a notable exception). However, I would recommend that data be collected on such issues as (i) whether workers are promoted by merit or seniority, (ii) whether they are given discretionary bonuses, (iii) how often they are formally evaluated, and (iv) whether evaluations are based on objective criteria or subjective criteria. Such data would be very useful to researchers in understanding how incentives are provided within firms.

---

with workers from many firms? To take one example, consider the issue of whether wage changes are serially correlated within firms. There is considerable work from the PSID and LEAD data sets on this issue, with mixed results. It is not yet clear how to evaluate the marginal product of work from personnel files that tackle the same issue. They clearly constitute a more restricted environment than the larger data sets, but all the observations are from one firm. What is the implication of this? Does the fact that the studies from personnel files suggest strong evidence of serial correlation mean that it is important to use other workers in the same firm as a benchmark?

## **V: Conclusion**

Empirical work on incentives and compensation policies within firms is still at an early stage. In truth, there are few areas where much is known with certainty, even at the level of the most basic question of all, Do Incentives Matter? The prime reason for this has been limitations on data. As a result, I feel that the most important advances in this field can be obtained by collecting more data on contracts and relating these to available measures of performance. This, of course, is easily said, but I believe that our understanding of the effect of incentives has been advanced enormously in just the last year by a series of papers which have taken this approach with much success. Each of these paper has illustrated large effects attributable to the use of pay-for-performance which needs to be further studied.

A second, and in my mind equally important, problem is that the available theoretical work has made too little progress in identifying the empirical implications of theories relative to some plausible alternatives. A recent paper by Baker and Holmstrom (1995), "Internal Labor Markets: Too Many Theories, Too Few Facts" summarizes their view of the prevailing state of knowledge in this field. I think that it is indeed true that we have far too few facts, but I also believe that there is need to carry out theoretical work that could take a more empirical approach, ultimately allowing data to answer the question "Can we distinguish between two supposedly plausible theories?" Without answering these conceptual questions, progress in this field may be severely limited.

## References

- Abowd, J. (1990), "Does Performance-Based Managerial Compensation Affect Corporate Performance?", *Industrial and Labor Relations Review*, 43, 52-74.
- Abowd, J. and D. Card (1989), "On the Covariance of Earnings and Hours changes", *Econometrica*, 57, 411-45.
- Abraham, K. and H. Farber (1987), "Job Duration, Seniority and Earnings", *American Economic Review*, 77, 278-97.
- Altonji, J. and R. Shakotko (1987), "Do Wages Rise with Job Seniority?", *Review of Economic Studies*,
- Antle, R. and A. Smith (1986), "An Empirical Investigation of the Relative Performance Evaluation of Corporate Executives", *Journal of Accounting Research*, 24, 1-39.
- Asch, B. (1990), "Do Incentives Matter? The Case of Navy Recruiters", *Industrial and Labor Relations Review*, 43, 89-107.
- Ashenfelter, O. and R. LaLonde (1995), "The Economics of Training", forthcoming, *Handbook of Human Resources*, North Holland, Amsterdam.
- Bailey, R. (1970), "Economies of Scale in Medical Practice", in Klarman, H., *Empirical Studies in Health Economics*, Johns Hopkins Press, Baltimore.
- Baker, G. and B. Holmstrom (1995), "Internal Labor Markets: Too Many Theories, Too Few Facts", forthcoming, *American Economic Review Papers and Proceedings*.
- Baker, G., M. Gibbs and B. Holmstrom (1994a), "The Wage Policy of a Firm", *Quarterly Journal of Economics*, 107, 921-57.
- Baker, G., M. Gibbs and B. Holmstrom (1994b), "The Internal Economics of a Firm: Evidence from Personnel Data", *Quarterly Journal of Economics*, 881-921.
- Barberis, N., M. Boycko, and A. Shleifer (1996), "How Does Privatization work? Evidence from Russian Shops", *Journal of Political Economy*, 104, 764-91.
- Barron, J., D. Black and M. Loewenstein (1989), "Job Matching and On-the-Job Training", *Journal of Labor Economics*, 7, 1-19.
- Beaudry, P. and J. Di Nardo (1991), "The Effect of Implicit Contracts on the Movement of Wages over the Business Cycle: Evidence from Micro Data", *Journal of Political Economy*, 99, 665-89.

- Becker, B. and M. Huselid (1992), "The Incentive Effects of Tournament Compensation Systems", *Administrative Science Quarterly*, 37, 336-50.
- Bishop, J. (1987), "The Recognition and Reward of Employee Performance", *Journal of Labor Economics*, 5, 36-56.
- Bretz, R. and G. Milkovich (1989), Performance Appraisals in Large Organizations: Practice and Research Implications", mimeo, Cornell University.
- Brown, C. (1990), "Firms' Choice of Method of Pay", *Industrial and Labor Relations Review*, 43, 165-183.
- Brown, J. (1989), "Why Do Wages Increase With Tenure?", *American Economics Review*, 79, 971-92.
- Bruderl, J., A. Diekmann and P. Preisdorfer (1991), "Patterns of Intraorganizational Mobility", *Social Science Research*, 20, 197-216.
- Cappelli, P. and K. Chauvin (1991), "An Interplant Test of the Efficiency Wage Hypothesis", *Quarterly Journal of Economics*, 106, 769-87.
- Card, D. and D. Hyslop (1995), "Does Inflation 'Grease the Whells of the Labor Market'?", mimeo, Princeton University.
- Chevalier, J. and G. Ellison (1995), "Risk Taking by Mutual Funds as a Response to Incentives", mimeo, University of Chicago.
- Chevalier, J. and G. Ellison (1996), "Are Some Mutual Fund Managers Better Than Others?", mimeo, University of Chicago.
- Chiappori, P-A., B. Salanie and J. Valentin (1996), "Insurance, Learning and Career Profiles: An Empirical Test", mimeo, INSEE.
- Coughlin, A. and C. Narasimhan (1992), "An Empirical Analysis of Sales-Force Compensation Plans", *Journal of Business*, 65, 93-123.
- Courty, P. and J. Marshke (1995), "Moral Hazard Under Incentive Systems: The Case of a Federal Bureaucracy", mimeo, University of Chicago.
- Drago, R. and G. Garvey (1994), "Incentives for Helping on the Job: Theory and Evidence", mimeo, University of Wisconsin-Milwaukee.
- Doeringer P. and M. Piore (1971), *Internal Labor Markets and Manpower Analysis*, Lexington,



Mass., Heath.

Ehrenberg, R. and M. Bognanno (1990), "The Incentive Effects of Tournaments Revisited: Evidence from the European PGA Tour", *Industrial and Labor Relations Review*, 43, 74-89.

Eriksson, T. (1996), "Executive Compensation and Tournament Theory: Empirical Tests on Danish Data", mimeo, Aarhus University.

Farber, H. (1994), "The Analysis of Inter-Firm Worker Mobility", *Journal of Labor Economics*, 12(4), 554-94.

Farber, H. and R. Gibbons (1996), "Learning and Wage Dynamics", forthcoming, *Quarterly Journal of Economics*.

Fernie, S., and D. Metcalf (1996), "'It's Not What You Pay But How You Pay It And That's What Gets Results': Jockey's Pay and Performance", mimeo, LSE.

Frank, R. and R. Hutchens (1993), "Wages, Seniority, and the Demand for Rising Consumption Profiles", *Journal of Economics, Behavior and Organization*, 21, 251-76.

Freeman, R. and J. Medoff (1984), *What Do Unions Do?*, New York, Basic Books.

Garen, J. (1994), "Executive Compensation and Principal-Agent Theory", *Journal of Political Economy*, 102, 1175-99.

Gaynor, M. and M. Pauly (1990), "Compensation and Productive Efficiency in Partnerships" Evidence from Medical Group Practice", *Journal of Political Economy*, 98, 544-74.

Gibbons, R. (1996), "Incentives and Careers in Organizations", NBER Working Paper #5705.

Gibbons, R. and K. J. Murphy (1990), "Relative Performance Evaluation for Chief Executive Officers", *Industrial and Labor Relations Review*, 43, 30-52.

Gibbons, R. and K. J. Murphy (1992), "Optimal Incentive Contracts in the Presence of Career Concerns", *Journal of Political Economy*, 100, 468-506.

Gibbons, R. and M. Waldman (1996), "A Theory of Wages and Promotion Dynamics Inside a Firm", mimeo, Cornell University.

Gibbs, M. (1995), "Incentive Compensation in a Corporate Hierarchy", *Journal of Accounting and Economics*, 19, 247-77.

Gibbs, M. and W. Hendricks (1996), "Are Administrative Pay Systems a Veil?", mimeo, University of Illinois.

- Glaeser, E. (1992), "Who Knows What About Whom", mimeo, University of Chicago.
- Gompers, P. and J. Lerner (1994), "An Analysis of Compensation in the U.S. Venture Capital Partnership", mimeo, Harvard Business School.
- Groshen, E. (1991), "Sources of Intra-Industry Wage Dispersion", *Quarterly Journal of Economics*, 106, 869-85.
- Groshen, E. and A. Krueger (1990), "The Structure of Supervision and Pay in Hospitals", *Industrial and Labor Relations Review*, 43, S134-47.
- Harris, M. and B. Holmstrom (1982), "A Theory of Wage Dynamics", *Review of Economic Studies*, 49, 315-333.
- Healy, P. (1985), "The Effect of Bonus Schemes on Accounting Decisions", *Journal of Accounting and Economics*, 7, 85-107.
- Holmstrom, B. (1982), "Managerial Incentive Problems: A Dynamic Perspective", mimeo, Kellogg School of Management.
- Holmstrom, B. and J. Tirole (1987), "The Theory of the Firm", in R. Schmalansee and R. Willig (eds.), *Handbook of Industrial Organization*.
- Holmstrom, B. and P. Milgrom (1992), "Multi-Task Principal Agent Analyses: Linear Contracts, Asset Ownership and Job Design", *Journal of Law, Economics, and Organization*, 7, 24-52.
- Hutchens, R. (1986), "Delayed Payment Contracts and a Firm's Propensity to Hire Older Workers", *Journal of Labor Economics*, 4, 439-57.
- Jensen, M. and K. J. Murphy (1990), "Performance Pay and Top Management Incentives", *Journal of Political Economy*, 225- 64.
- John, G. and B. Weitz (1989), "Salesforce Compensation: An Empirical Investigation of Factors Related to the Use of Salary versus Incentive Compensation", *Journal of Marketing Research*, 26, 1-14.
- Jones, D. and T. Kato (1995), "The Productivity Effects of Employee Stock-Ownership Plans and Bonuses", *American Economic Review*, 85(3), 391-415.
- Kahn, L. and P. Sherer (1990), "Contingent Pay and Managerial Performance", *Industrial and Labor Relations Review*, 43, 107-21.
- Kaplan, S. (1994), "Top Executive Rewards and Firm Performance: A Comparison of Japan and

- the United States", *Journal of Political Economy*, 510-46.
- Kawasaki, S. and J. McMillan (1987), "The Design of Contracts: Evidence from Japanese Subcontracting", *Journal of the Japanese and International Economies*, 1, 327-49.
- Knoeber, C. (1989), "A Real Game of Chicken: Contracts, Tournaments and the Production of Broilers", *Journal of Law, Economics, and Organization*, 5(2), 271-92.
- Knoeber, C. and W. Turman (1994), "Testing the Theory of Tournaments: An Empirical Analysis of Broiler Production", *Journal of Labor Economics*, 12, 155-79.
- Kotlikoff, L. and J. Gokhale (1992), "Estimating a Firm's Age-Productivity Profile Using the Present Value of Workers' Earnings", *Quarterly Journal of Economics*, 1215-43.
- Krueger, A. and L. Summers (1988), "Efficiency Wages and the Inter-Industry Wage Structure", *Econometrica*, 56, 259-93.
- Larkey, P. and J. Caulkins (1992), "All Above average", mimeo, Carnegie Mellon University.
- Lazear, E. (1981), "Agency, Earnings Profiles, Productivity, and Hours Restrictions", *American Economics Review*, 71, 606-20.
- Lazear, E. (1989), "Pay Equality and Industrial Politics", *Journal of Political Economy*, 97, 561-80.
- Lazear, E. (1991), "The Job as a Concept", mimeo, University of Chicago.
- Lazear, E. (1996), "Performance Pay and Productivity", NBER Working Paper #5672.
- Lazear, E. and R. Moore (1986), "Incentives, Productivity and Labor Contracts", *Quarterly Journal of Economics*, 99, 275-96.
- Lazear, E. and S. Rosen (1981), "Rank Order Tournaments as Optimal Labor Contracts", *Journal of Political Economy*, 89, 841-64.
- Leibowitz, A. and R. Tollison (1980), "Free Riding, Shirking and Team Production in Legal Partnerships", *Economic Inquiry*, 18, 380-394.
- Lillard, L. and Y. Weiss (1979), "Components of Variation in Panel Data: American Scientists 1960-70", *Econometrica*, 47, 437-54.
- Loewenstein, G. and N. Sicherman (1991), "Do Workers Prefer Increasing Wage Profiles?", *Journal of Labor Economics*, 9, 67-84.

- Leonard, J. (1987), "Carrots and Sticks: Pay, Supervision, and Turnover", *Journal of Labor Economics*, 5, s136-s152.
- Main, B., C. O'Reilly and J. Wade (1993), "Top Executive Pay: Tournament or Teamwork", *Journal of Labor Economics*, 11, 606-28.
- Marschke, J. (1996), "Incentives in a Government Bureaucracy", mimeo, University of Chicago.
- Medoff, J. and K. Abraham (1981), "Are Those Paid More Really More Productive: The Case of Experience", *Journal of Human Resources*, 186-216.
- Milgrom, P. and J. Roberts (1990), "The Efficiency of Equity in Organizational Decision Processes", *American Economic Review*, 80, 154-59.
- Mincer, J. (1986), "Wages Changes in Job Changes", *Research in Labor Economics*, 8, 171-97.
- Murphy, K. J. (1986), "Incentives, Learning and Compensation: A Theoretical and Empirical Investigation of Managerial Labor Contracts", *Rand Journal of Economics*, 17, 59-76.
- Newhouse, J. (1973), "The Economics of Group Practice", *Journal of Human Resources*, 8, 37-56.
- Oyer, P. (1995), "The Effect of Sales Incentives on Business Seasonality", mimeo, Princeton University.
- Paarsch, H. and B. Shearer (1996), "Fixed Wages, Piece Rates, and Incentive Effects", mimeo, University of Laval.
- Prendergast, C. and R. Topel (1996), "Favoritism in Organizations", *Journal of Political Economy*, 104(5), 958-78.
- Putterman, L. (1990), "Effort, Productivity, and Incentives in a 1970s Chinese People's Commune", *Journal of Comparative Economics*, 14, 88-104.
- Rosen, S. (1982), "Authority, Control, and the Distribution of Earnings", *Bell Journal of Economics*, 13, 311-23.
- Rosen, S. (1986), "Prizes and Incentives in Elimination Tournaments", *American Economic Review*, 76, 921-39.
- Rosenbaum, J. (1979), "Tournament Mobility: Career Patterns in a Corporation", *Administrative Science Quarterly*, 24, 220-40.
- Shaefer, S. (1994), "The Dependence of CEO Pay-Performance Sensitivity on the Value of the

Firm", mimeo, Stanford University.

Sicherman, N. (1995), "Gender Differences in Departures From a Large Firm", *Industrial and Labor Relations Review*, 49, 484-505.

Spilerman, S. (1986), "Organizational Rules and the Features of Work Careers", *Research in Social Stratification and Mobility*, 5, 41-102.

Spilerman, S. and H. Ishida (1994), "Stratification and Attainment in Large Japanese Firms", mimeo, Columbia University.

Spilerman, S. and T. Petersen (1993), "Organizational Structure, Determinants of Promotion, and Gender Differences in Attainment", mimeo, Columbia University.

Spurr, S. and W. Barber (1994), "The Effects of Performance on a Worker's Career: Evidence from Minor League Baseball", *Industrial and Labor Relations Review*, 47, 692-709.

Topel, R. (1991), "Specific Human Capital, Mobility and Wages: Wages Increase With Job Seniority", *Journal of Political Economy*, 99, 145-76.

Topel, R. and M. Ward (1992), "Job Mobility and the Careers of Young Men", *Quarterly Journal of Economics*, 107, 439-79.

Weiss, A. (1987), ""Incentives and Worker Behavior", in *Information, Incentives and Risk Sharing*, H. Nalbantian (ed.).