Performance Pay and Wage Inequality

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Abstract

An increasing fraction of jobs in the U.S. labor market explicitly pay workers for their performance using a bonus, a commission, or a piece rate. In this paper, we look at the effect of the growing incidence of performance pay on wage inequality. The basic premise of the paper is that performance pay jobs have a more "competitive" pay structure that rewards productivity differences more than other jobs. Consistent with this view, we show that compensation in performance pay jobs is more closely tied to both measured (by the econometrician) and unmeasured productive characteristics of workers. We conclude that the growing incidence of performance pay accounts for 25 percent of the growth in male wage inequality between the late 1970s and the early 1990s, and for most of the growth in top-end wage inequality (above the 80th percentile) during this period.

1 Introduction

In the standard competitive model of the labor market, wages are equal to marginal products and the wage structure is determined by the equilibrium of demand and supply factors. This simple model forms the backbone of most studies on the evolution of wage inequality. For example, Katz and Murphy (1992) argue that the return to schooling increased in the 1980s because the rate of increase in the relative supply of more-educated labor decelerated while relative demand was increasing steadily. Similarly, Juhn et al. (1993) argue that the growth in within-group wage inequality throughout the 1970s and 1980s was driven by an increase in the demand for unobserved skills. More generally, an important advantage of the standard competitive model of the labor market is that it provides a straightforward interpretation of the evolution of the wage structure in terms of the supply and demand for different types of labor.

This being said, it is also well established that the competitive model is at best a good approximation for the way wages are actually determined in the labor market. Unless markets are complete and information is perfect, wages will generally not be equal to marginal products. There are indeed a large number of studies that confirm that wages are not equal to marginal products because of incomplete markets, incomplete (or asymmetric) information, or other considerations. For instance, Beaudry and DiNardo (1991) show compelling evidence that wages depend on labor market conditions at the time a worker started his or her job. This is consistent with a simple risk-sharing implicit contract, but inconsistent with the competitive model that predicts that wages should only depend on current labor market conditions. Farber and Gibbons (1996) and Altonji and Pierret (2001) provide evidence that wages are not equal to marginal products because information is imperfect and it takes time to firms to learn about the actual productivity of workers.

A more "mundane" reason why wages are not equal to marginal products is the presence of labor market institutions. For example, it is well established that labor unions tend to compress the wage structure (Freeman (1980), Card (1996), Lemieux (1998)) and reduce the wage difference between more productive and less-productive workers relative to a non-union setting. Similarly, a substantial number of workers at the bottom end of the wage distribution are paid a legislated minimum wage instead of their actual marginal product.

Because of these contracting, observability, and institutional factors, wages are clearly not equal to marginal products and the full distribution of wages is not simply determined by standard demand and supply factors. This does not necessarily mean, however, that changes in the wage distribution are not well explained by changes in demand and supply factors. For example, if contracting, observability, and institutional factors introduce a purely random difference (error term) between wages and marginal products, changes in the wage structure will not be affected by these factors. Put in these terms, the key question is not whether the competitive model is only an approximation for the way wages are actually set, but whether the quality of the approximation is constant over time.

Existing studies already show, however, that the effect of labor market institutions is neither random nor stable over time. For instance, DiNardo et al. (1996) attribute to the decline in unionization and in the real value of the minimum wage about a third of the increase in wage inequality in the 1980s. In the context of the above discussion, their findings suggest that the competitive model has become an increasingly good approximation for the way wages are actually set in the labor market. Part of the increase in wage inequality thus reflects the fact that workers who used to earn a union or a minimum wage are now earning a more competitive wage.

These findings raise the obvious question of whether departures between wages and marginal products induced by factors other than labor market institutions may have also changed over time. There are indeed a number reasons to believe that this may be the case. For example, improvements in the functioning of financial markets may reduce the need for firms to provide insurance to workers through implicit contracts. As a result, firms may be paying a wage that is increasingly close to the actual marginal product of workers. Another relevant change is the advances in information and communication technologies that have dramatically reduced to cost of gathering and processing information. One important implication of these changes is that it may now be cheaper for firms to collect and process detailed information about the individual performance and the productivity of workers. In about any model where wages are not set to marginal products because information is costly, a reduction in the cost of information will lead to wages being closer to marginal products.

While it is not generally possible to know whether or not individual wages are equal to marginal products, some observable variables about the form of compensation used may be useful proxies for how close wages are to marginal products. In particular, the basic assumption of this paper is that total compensation on jobs that pay for performance using a bonus, a commission, or a piece rate will tend to be closer to marginal products than compensation on jobs that do not pay for performance.

The contribution of the paper is threefold. We first show, using data from the Panel Study of Income Dynamics (PSID), that the incidence of performance pay has increased substantially since the late 1970s. This increase is consistent, for instance, with the view that the cost of collecting and processing information has declined over time with the advances in information and communication technologies. Second, we show that wages are be less equally distributed in performance pay jobs than in other jobs because the return to productive characteristics like education is larger in performance pay jobs. Combining these two sets of findings together, we then show that the growth in performance pay jobs has contributed substantially to the rise in wage inequality in the United States between the late 1970s and the early 1990s. We also complement the evidence from the PSID with a brief analysis of the National Longitudinal Survey of Youth (NLSY).

The paper is an interesting complement to studies on labor market institutions that tend to focus on a very different segment of the workforce. We show that workers paid for performance are relatively unlikely to belong to unions or to be paid around the minimum wage. Just like the decline of unionization and in the real value of the minimum wage may have made wages in the middle and low end of the wage distribution closer to marginal products, the growing incidence of performance pay appears to be producing a similar outcome for workers higher up in the wage distribution. This is particularly important in light of the fact that changes in inequality are increasingly concentrated in the top-end of the wage distribution (see, for example, Autor et al. (2006) and Lemieux (2006b)).

The plan of the paper is as follows. In section 2, we present a simple measurement model where performance pay is viewed as a indicator that firms pay wages that are closer to the marginal product of workers than firms that do not pay for performance. We also derive a number of testable implications from the simple model. In Section 3, we present the data used for the empirical analysis and illustrate the growth in the incidence of performance pay over time. Section 4 presents estimates from the PSID of the effect of performance pay on the wage structure, supplemented with some corroborating evidence from the NLSY. We argue that this evidence is consistent with the view that wages on performance pay jobs are closer to marginal products than wages on other jobs. We then show in Section 5 how the growth in performance pay has contributed to the growth in wage inequality between the late 1970s and the early 1990s. We conclude in Section 6.

2 Measurement Model

The basic idea of the model is very simple. We start with the traditional distinction between cases where "wages are attached to jobs" , and cases where "wages are attached to workers". In the former case, the workers' wages and salaries solely depend on the job they hold. All workers working on the same job for the same firm are paid the same way. For example, each job classification may correspond to a specific wage grid that depends on seniority with the firm. One prime example of jobs that often pay that way are union jobs where the firm and the union collectively bargain to set the specific wage grid. Even outside the union sector, however, compensation consultants, such as Hay, have developed systems to measure the skills needed for a job, which in turn implies that wages reflect the features of the job rather than the unique abilities of the worker. While some formal models could be used to show why it could be optimal for firms, in some settings, to pay wages attached to jobs, we do not attempt to provide such an explanation in this paper. We simply note that, econometrically speaking, only job characteristics, including seniority, should have an effect on wages when wages are attached to jobs. This means that, conditional on job characteristics, individual productive characteristics of workers such as education have no effect on their wages. Of course, the unconditional effect of education on earnings will still be positive if education helps workers get better paid jobs.

The result wage setting equation of worker i working for firm j at time t when wages are attached to jobs is:

$$y_{ijt}^{J} = z_{ijt}\varphi_t + \nu_{ij} + e_{ijt}$$

where z_{ijt} is a set of observed job characteristics like occupation or seniority, ν_{ij} is a "firm-specific" wage term that captures differences in wage policies across firms, and e_{ijt} is an idiosyncratic pay component. The firm-specific component ν_{ij} could be linked, for instance, to the average level of productivity of workers employed by the firm. Even if firms do not observe individual productivities, firms that turn out to have more productive workers will be able to pay higher average wages to all workers. Alternatively, ν_{ij} could capture the fact that some firms pay better than others because of reasons such as rent-sharing.

The other polar case we consider is when wages are "attached to workers" in the sense that workers are paid their marginal products, irrespective of the job they hold. This correspond to a traditional human capital pricing model where workers a simply paid for the marginal product of their human capital. As in the case of wages attached to jobs, we do not discuss here why it is that some firms pay wages equal to marginal products, while other do note. We simply note that, starting the in the late 1970s, many compensations consultants (e.g. Ed Lawler) began recommending that firms pay the worker rather than the job using formal evaluation of worker performance. One possible reason for these changes is that formal evaluation of worker performance may now be easier to implement in practice with advances in information processing technologies.

The resulting competitive wage setting equation when wages are attached to workers is a traditional wage equation:

$y_{ijt}^W = x_{it}\beta_t + d_t\theta_i + u_{ijt}$

where x_{it} represents standard measurable (by the econometrician) characteristics like potential experience and education, θ_i represents a worker-specific productivity term, and u_{ijt} is an idiosyncratic productivity term. The parameters β_t and d_t are the returns (in terms of productivity) to measured and unmeasured characteristics.

As discussed in the introduction, existing measures of performance pay are only an imperfect indicator of whether a firms pays wages attached to jobs, or wages attached to workers (competitive wages). For example, some firms may be paying an end of year bonus to all workers, irrespective of their performance. In that case, the fact that bonuses are used does not mean that wages are equal to marginal products. By contrast, other firms may be paying straight wages that nonetheless end up being very to close to the actual productivity of the workers. In such cases, firms pay wages attached to workers even if we don't formally observe performance pay schemes such as bonuses, commissions, or piece-rates. To capture these possibilities, let s^p and s^n be the probability that workers on performance pay jobs (p) and non-performance pay jobs (n), respectively, are actually paid their marginal product, y_{ijt}^W. For performance pay to be an informative measure, it must be that $s^p > s^n$, i.e. that workers who are paid for performance are more likely to by paid on the basis of their marginal product than workers who are not paid for performance. Conditional on performance pay, the expected wage of worker i at time t becomes:

$w^p_{ijt} = x_{it}\beta^p_t + z_{ijt}\varphi^p_t + d^p_t\theta_i + \nu^p_{ij} + \varepsilon^p_{ijt}$,

for performance pay jobs, and

$w^n_{ijt} = x_{it}\beta^n_t + z_{ijt}\varphi^n_t + d^n_t\theta_i + \nu^n_{ij} + \varepsilon^n_{ijt}$,

for non-performance pay jobs, where

$\beta^p_t = s^p\beta_t$, $\beta^n_t = s^n\beta_t, \varphi^p_t = (1 - s^p)\beta_t, \varphi^n_t = (1 - s^n)\beta_t, d^p_t = s^p d_t$, $d^n_t = s^p d_t$,

and

$var(\nu^b_{ij}) = (1 - s^p)var(\nu_{ij})$, $var(\nu^n_j) = (1 - s^n)var(\nu_{ij})$,

$var(\varepsilon^p_{ijt}) = (s^p)var(u_{ijt}) + (1 - s^p)var(e_{ijt}), var(\varepsilon^n_{ijt}) = (s^n)var(u_{ijt}) + (1 - s^n)var(e_{ijt})$

A number of interesting predictions can be drawn from this model:

1. The return to measurable characteristics x_{it} is larger in performance pay jobs than non-performance pay jobs ($\beta^p_t > \beta^n_t$)

2. The return to job characteristics z_{ijt} is smaller in performance pay jobs than non-performance pay jobs ($\varphi^p_t > \varphi^n_t$)

3. The return to unmeasurable person-specific characteristics θ_i is larger in performance pay jobs than non-performance pay jobs ($d^p_t > d^n_t$). One related implication is that, for a given distribution of θ_i, the variance of the person-specific component will be larger in performance pay than non-performance pay jobs. When comparing workers on performance pay and non-performance pay jobs, the variance could also be different because of differences in the variance of θ_i among these two groups of workers. We will adjust for this empirically by comparing the variance of the person-specific component in performance pay and non-performance pay jobs for a subsample of "switchers" who are observed both on performance pay and non-performance pay jobs.

4. The variance of the firm-specific component is smaller in performance pay jobs than non-performance pay jobs ($var(\nu^p_{ij}) < var(\nu^n_{ij})$)

5. The variance of the idiosyncratic term in performance pay jobs, $var(\varepsilon^p_{ijt})$, may either be larger (if $var(u_{ijt}) > var(e_{ijt})$) or smaller (if $var(u_{ijt}) < var(e_{ijt})$) than the

variance of the idiosyncratic term in non-performance pay jobs, $var(\varepsilon^n_{ijt})$.

The predictions will be tested in Section 4. Note, however, that it is not clear from these predictions what will be the effect of performance pay on wage inequality. Remember that, in our framework, an increase in performance pay means that a higher share of workers are paid their marginal products. Predictions 1 and 3 mean that returns to (measured and unmeasured) skills increase when the fraction of performance pay jobs increases, which, in turns, results in more wage inequality. This may be partly offset, however, by that fact that inequality linked to job characteristics (prediction 2) and firm effects (prediction 4) decreases when the fraction of performance pay jobs decreases. Whether or not performance pay results in more wage inequality is, thus, an empirical question that will be addressed explicitly in Section 5.

3 Data

The bulk of our analysis is conducted using data from the PSID. The main advantage of the PSID is that it provides a representative sample of the workforce for a relatively long period, which is essential for studying the effect of pay for performance on wage inequality. One disadvantage of the PSID, however, is that our constructed measures of performance pay are relatively crude and may be fairly imperfect proxies for whether or not workers are paid their marginal products. To probe the robustness of the results based on the PSID, we thus re-estimate some of the key models using the NLSY. The main advantage of the NLSY is that it asks workers directly whether or not their earnings are based on performance, bonuses, or commissions. This is arguably a better measure of performance pay than what is available in the PSID. Unfortunately, the question about performance pay in the NLSY was only included in the late 1980s and late 1990s. Combined with the fact that the NLSY only follows a narrow cohort of individuals over time, it is not possible to use the NLSY to look at the broad-based impact of performance pay on changes in wage inequality.

3.1 The Panel Study of Income Dynamics (1976-1998)

The PSID sample we use consists of male heads of households aged 18 to 65 with average hourly earnings between \$1.00 and \$100.00 (in \$79) for the period spanning the years 1976-1998, where the hourly wage rate is obtained by dividing total earnings in the previous year by hours of work. .[1] Individuals in the public sector or who are self-employed are excluded from the analysis. This leaves us with a total sample of 30,424 observations for 3,181 workers. Summary statistics are reported in Table 1 and will be discussed below.

3.1.1 Measurement Issues

Identifying performance pay In the PSID, we construct a performance pay indicator variable by looking at whether part of a worker's total compensation includes a variable pay component (either a bonus, a commission, or a piece rate). For interview years 1976-1992, we are able to determine whether a worker received a bonus or a commission over the previous calendar year through the use of multiple questions. First, workers are asked the amount of money they received from either working overtime, from commissions, or from bonuses paid by the employer.[2] Second, we know whether workers worked overtime, and if they are working overtime in a given year, we classify them as not having a variable pay component.[3] Third, workers not paid exclusively by the hour or not exclusively by a salary are asked how they are paid: they can report being paid commissions, piece rates, etc., as well as combinations of salaried/hour pay with either pieces rates or commissions.[4] Through this

[1] In the PSID, data on hours worked during year t, as well as on total labor earnings, bonuses/commissions/overtime income, and overtime hours, are asked interview year t+1. Thus we actually use data covering interview years 1976-1999.

[2] Note that the question refers specifically to any amounts earned from bonuses, overtime, or commissions in addition to wages and salaries earned.

[3] In some years overtime hours are reported while in other years we only know whether they worked overtime or not.

[4] In many survey years workers are not asked if their compensation package involves a mixture of salary/hourly pay and a variable component. All they are asked is how they are paid if not by the hour or a salary. Although there is no way to directly verify it, this likely results in understating the incidence of either form of variable pay because workers are not allowed to answer that they are paid, say, a salary, and then report a commission: they have to choose. Our assertion that it likely understates the extent of variable pay is motivated in part by the fact that workers in the NLSY, to be described below, are not restricted in describing the way they are paid, and workers in the NLSY are more likely to report having part of their

combination of questions, we are thus able to identify all non-overtime workers who received performance pay in the form of either a bonus, a commission, or a piece rate. Starting with interview year 1993, there are separate questions on the amounts earned in bonuses, commissions, tips, and overtime work over the previous calendar year. Thus there is no need to back out an estimate of bonuses from an aggregate amount since the question is asked directly. For the sake of comparability with the pre-1993 years, we nevertheless classify as receiving no variable pay all workers who report any overtime work. Thus for each year of the employment relationship we are able to determine whether the worker's total compensation included a variable pay component. One obvious drawback is that it is likely the variable pay component we construct will be noisy. However, due to our treatment of overtime workers, we conservatively lean on the side of misclassifying workers as receiving no variable pay, even if they do.

Defining performance pay jobs[5] One of the main goals of this paper is to see whether employment relationships that involve performance are systematically different from those in which no such performance pay is ever received. Thus we define performance pay jobs as employment relationships in which part of the worker's total compensation includes a variable pay component (either a bonus, a commission, or a piece rate) at least once during the course of the relationship. In some sense, we are not so much interested in what happen within an employment relationship at the time some performance pay such as a bonus is received, as to what is the difference between one type of job and the other.[6] Two related measurement issues arise. The first one is a simple measurement error issue. On the one hand, we are likely to misclassify performance pay jobs as non performance pay jobs if some employment relationships are terminated before performance pay is received. This would be particularly problematic if the first receipt performance pay, which identifies the job as a performance pay job, tends to occur later instead of sooner in the course of the employment

compensation package containing a variable pay component.

[5]To avoid confusion, note that we use "jobs", "employment relationship", and "job match" interchangeably. Although in most of the survey years spanning the sample period, the PSID does have information on tenure in the position, we are not using it. As is well known, simply determining employer tenure in the PSID can be problematic (Brown and Light (1992)).

[6]That being said, we also look at the within job impacts using an alternative definition of a performance pay job. More on that below.

relationship. On the other hand, some of the jobs are wrongly classified as performance pay jobs for reasons discuss earlier (e.g. end of year bonus). While it is a priori difficult to assess which of the false positive or false negative problems are more important, their consequence is the same: assuming there is a genuine difference between the two types of jobs, misclassification will tend to attenuate such differences. Our measurement model explicitly deals with this issue by introducing the probabilities s^p and s^n. "False positives" mean that $s^p < 1$, while "false negatives" mean that $s^n > 0$.

The second related issue is an "end point" problem: given our definition of performance pay jobs, we may mechanically understate the fraction of workers in such jobs at the start of our sample period because most employment relationships started before 1976. Similarly, jobs which started toward the end of the sample period may be performance pay jobs but are classified otherwise because they have not lasted long enough for performance pay to be observed. The basic measurement problem is that, conditional on job duration, we tend to observe a given job match fewer times at the two ends of our sample period than in the middle of the sample period. Consider, for example, the case of a job that lasts for five year. For jobs that last from 1985 to 1989, all five observations on this job match are captured in our PSID sample. For jobs that last from 1973 to 1977, however, only two of the five years of the job match are captured in our PSID sample, which mechanically reduces the probability of classifying the job as performance pay.

The source of the "end point" problem is thus that it results in an unbalanced distribution of the number of observed job match observations at different point of the sample period. One simple solution to the problem is to "rebalance" the sample using regression or other methods. In practice, what we do is to create a variable counting the number of job matches observed for each job (as opposed to the actual job duration), and then add this variable as an additional control in the regression models. Similarly, the corrected incidence of performance pay over time can be computed by running a linear probability model (or a logit) in which year dummies and the number of times the job-match is observed are included as regressors. The year dummies then capture the corrected incidence of pay for performance job. All the graphs of the incidence of pay for performance reported below are adjusted using this procedure.[7]

[7] Note that the PSID became a bi-annual survey after 1996. This poses a problem in aligning job in-

Descriptive statistics Table 1 compares the sample characteristics of workers on performance pay and non-performance pay jobs, respectively. First notice that 37 percent of the 30,424 observations are in performance pay jobs, though these raw figures must be interpreted with caution because of the end-point problem discussed earlier. Workers on performance pay jobs tend to earn more and be more educated than workers on non-performance pay jobs. Note that the hourly wage rate includes both regular wage and salary earnings and performance pay in the case of workers on performance pay jobs. Annual hours worked and employer tenure also tends to be higher for workers on performance pay than non-performance pay jobs.

Not surprisingly, the unionization rate (percent covered by collective bargaining agreements) is much lower among performance pay workers, suggesting that, as expected, pay structure in union firms tend to have wages attached to jobs instead of workers. Another important difference is that there is a much higher fraction of workers paid by the hour in non-performance than performance pay jobs. On the flip side, workers on performance pay jobs are much more likely to be salaried workers than those on non-performance pay jobs. This is an important point since the growth in wage inequality has been stronger among salaried than hourly workers (Lemieux (2006a)). Performance pay is thus more likely to affect the very group of workers who have experienced the largest increase in inequality, and who are also least likely to be affected by other institutional factors such as the minimum wage or de-unionization.

The cross tabulations shown in Table 2 confirm that performance pay is more prevalent in high-wage occupations like professional, managers, and sales workers than in other occupations. For example, the fraction of workers on performance pay jobs ranges from only 14 percent for laborers, to 44 percent for managers. By contrast, performance pay is used fairly evenly across industries except for construction where it is not very prevalent, and finance, insurance and real estate (FIRE) where is very widely used.

Figure 1 provides additional descriptive information on the distribution of wages for performance pay and non-performance pay jobs by reporting kernel density estimates of the distribution of hourly wages. The figure shows that hourly wages have a higher mean and

formation (tenure, industry, etc.) which relate to the job held at the interview to the earnings information, including bonus amounts, which is for the calendar year before the interview.

median, are less evenly distributed in performance pay than non-performance pay jobs.

We next turn to the time trends in the prevalence performance pay. Figures 2a to 2e show the evolution of the fraction of performance pay jobs for various subgroups of the workforce. In all cases, we correct for the end-point problem by estimating a linear probability model in which we control for year dummies and the number of times each job-match is observed. The incidence of pay for performance jobs reported in the figures is then the predicted probabilities implied by the estimates year effects, holding the number of observed job matches at a fixed value (close to the mean for the relevant sample analyzed). In all figures, we also report the simple incidence of pay for performance obtained by computing the fraction of workers who report some performance pay in a given year. As argued above, this strongly understates the incidence of performance pay jobs since workers on performance pay jobs will not necessarily receive a performance payment (like a bonus) in each year on the job. The advantage of this simple measure, however, is that it is not affected by the end-point problem and provides additional evidence on the robustness of the underlying trends in performance pay.

Figure 2a shows that the overall incidence of performance pay jobs has increased from a little more than 30 percent in the late 1970s to over 40 percent in the 1990s. The incidence is computed holding the number of times a job-match is observed at 5, which is close to the average value in the sample. The simpler measure based on the fraction of workers reporting performance pay in a given year also clearly increases over time, especially in the 1980s. Figure 2a also shows the fraction of workers covered by a collective bargaining agreement. Remarkably, the line showing the fraction of unionized workers is almost the mirror image of the performance pay job incidence line.

As mentioned earlier, the decline in unionization has been found to be an important contributor to increased wage inequality in the United States, and on the surface it would appear that one simple mechanism by which de-unionization would have increased wage dispersion is by allowing firms to offer more variable pay, possibly in the form of bonuses. However, as we can see in Figures 2b and 2c, a particularly informative way of looking at the increase in the incidence of performance pay jobs is to break it down by how workers are paid. While it is true that performance pay job incidence shows some increase in hourly paid jobs at the same time as those jobs went through rapid de-unionization (Figure 2b), the bulk of the increase in Figure 2a is driven by salaried workers who are not likely to be unionized at any time (Figure 2c). The increase in the incidence of performance pay jobs among salaried workers illustrated in Figure 2c is quite remarkable. It increases from about 30 percent in the late 1970s to close to 50 percent by the end of the sample period.

A strong case for a simple de-unionization explanation would have been found if, for example, the fraction of performance pay jobs was constant in both the union and non-union sectors across all years and the combination of de-unionization with the fact that non-union jobs have more performance pay could have produced the overall increase shown in Figure 2a. Figures 2d and 2e show, however, that the incidence of performance pay jobs increased both among union and non-union workers, though the increase was somewhat steadier among non-union workers.

In the analysis of the wage structure and wage inequality presented in the next sections, we use a measure of hourly wages defined as the ratio of all earnings (whether paid for performance or not) over hours of work.

Next in Figure 3 we show the distribution of the share of performance pay in total labor earnings. To compute the share we use the amounts directly reported by respondents over the 1993-1999 period for the amounts earned in commission, bonuses, and tips earned in the previous calendar year.[8] Given that the median share is about 3.5% of total earnings, it is clear that performance pay, per se, only represents a relatively modest component of total compensation. We thus interpret the presence of performance pay as only an indicator that wages (both the straight wage and the performance pay component) are paid more competitively in performance pay than non-performance pay jobs.

3.2 Performance pay in the NLSY and other data sources

As mentioned earlier, we also provide some supporting evidence from the NLSY that asks more explicitly about pay for performance in the 1988, 1989, 1990, 1996, 1998 and 2000

[8]Note that it also possible to back out an estimate of bonus amounts earned in pre-1993 data by using the set of questions on amounts earned in overtime, bonuses, or commissions and the questions on overtime work and pay method. Turning to "missing" all observations in which respondents either worked overtime of report commissions earnings, we get an estimate of bonuses earned. The resulting distribution of the share of bonuses earned is very similar to the one shown on Figure 3.

waves of the panel. To simplify the analysis, we pool the 1988-1990 observations into a "late 1980s" period, and the 1996-2000 observations into a "late 1990s" period. As in the case of the PSID, we only focus on males. We also impose a couple of additional sample restrictions similar to those used by Gibbons et al. (2005). As in the case of the PSID, we classify a job as a performance pay job when the worker reports performance pay at least once on this job. Note, however, that the limited number of years in which performance pay is measured means that we are less likely to "catch" performance pay jobs. We nonetheless find that the incidence of performance pay jobs increases from 26.1 percent in the late 1980s to 30 percent in the late 1990s, which is broadly consistent with the evidence from the PSID.

As an additional check of the robustness of the trends in performance pay, we also looked at an additional source of information based on survey of Fortune 1000 corporations conducted between 1987 and 2003 (see Lawler (2003)). The surveys asks firms about the fraction of their workers with some forms of performance pay and reports results in categories such as 0 to 9 percent, 10 to 19 percent, etc. We compute the implied fraction of workers with performance pay using the mid-points of these intervals. The implied fractions are 20.7 in 1987, 27.1 in 1990, 34.7 in 1996, and 44.5 in 2002. Once again, these trends confirms the growth in performance paid measured (imperfectly) in the PSID data.

4 The wage structure in performance pay and non-performance pay jobs

The model of Section 2 provides a number of testable implications on how the structure of wages should differ in performance pay and non-performance pay jobs. In this section, we present the main estimation results and discuss how they relate to the predictions of the model of Section 2.

Table 3 reports a number of simple regression estimates of the effect of performance pay on wages (full compensation, including the pay for performance payments). Note that there are no particular reasons to expect that pay for performance jobs pay more (or less) than non-performance pay jobs. The main predictions outlined in Section 2 rather have to do with differences in the returns to measured and unmeasured characteristics in the two sectors.

The first column of Table 3 reports the results of a simple OLS regression of the log hourly wage on a dummy for performance pay jobs. The regressions reported in Table 3 also control for education, experience, seniority and occupation. The estimated effect is positive (7-8 percent) and statistically significant. The second column shows that the effect of having a pay for performance job declines by half when a dummy for performance pay received during the year is included. When worker specific fixed effects are introduced in column 3, the effect of performance pay jobs becomes essentially zero and insignificant, while the effect of receiving pay for performance in a given year remains positive and significant.

These results suggest two interesting observations. First, including standard controls for measured and unmeasured workers characteristics (column 3) explains the whole difference in raw wages between performance pay and non-performance pay jobs documented in Table 1. This is a useful result since there is no reason, a priori, to expect that performance pay jobs should pay more after adjusting for differences in workers characteristics. This suggests that the relevant heterogeneity is captured by the covariates and the worker-specifc fixed effect. A second useful observation is that the estimated effect of pay for performance payment in a given year is around 5 percent in column 3 and in column 4 where we further control for worker-job fixed effects (the effects of performance pay jobs is no longer identified in this specification). This is quite similar to the average magnitude of performance pay income reported in Figure 3, which in turns suggest that we are simply capturing the "mechanical" effect of performance in a given year. This further supports the view that heterogeneity is well controlled for once fixed effects are included in the specifications. In the presence of uncontrolled heterogeneity correlated with pay for performance payment, we would expect the estimated coefficient to be biased up above the expected mechanical effect of around 5 percent.

Table 4 provides a first direct test of some of the implications of the model of Section 2. Columns 1 and 2 report separate estimates of a standard wage equation for performance pay and non-performance pay jobs, respectively. Once again, the estimated models include both standard human capital characteristics like education and experience (the variables x_{it} in Section 2), and job characteristics such as seniority and occupation dummies (the variables z_{ijt} in Section 2). As expected, the return to education and potential experience is larger in performance pay than non-performance pay jobs. The return to education is

40 percent larger in performance pay than non-performance pay jobs (0.093 vs. 0.066) while the return to experience is 60 percent larger (0.0093 vs. 0.0058). The same pattern of results can be observed in Figure 4 that shows in more detail the relationship between wages and education in performance pay and non-performance pay jobs. The results also remain relatively unchanged when a person-specific fixed effect is introduced in columns 3 and 4. For instance, the coefficient on education is 0.018 larger in bonus than non-bonus jobs (compared to a 0.028 difference in OLS models). Note that we estimate a pooled model with interactions because education is almost time-invariant (for a given person) in our PSID sample. This means that we cannot separately identify the effect of education from the fixed effect when running separate models for performance pay and non-performance pay jobs. The interaction term between performance pay and education is still identified, however, because of the "switchers" who that are both observed on performance pay and non-performance pay jobs. The results for education mean, for example, that more educated workers get a bigger wage gain from switching from a non-performance pay to a performance pay job than less educated workers. Overall, the results support the implication of the model that returns to measured skills are higher in performance pay than non-performance pay jobs.

By contrast, the effect of seniority is lower in performance pay than non-performance pay jobs. This is consistent with the view that seniority is a job characteristics that matters when wages are attached to jobs, but not when wages are attached to workers. The difference remains significant (and quantitatively larger) when worker fixed effects are added in columns 3 and 4. The other key set of job characteristics we focus on are occupation dummies. Table 5 shows both OLS and fixed effect estimates of the (one-digit) occupation effects for performance pay and non-performance pay jobs (the other variables shown in Table 4 are included in these regressions but not reported in the table). As in Gibbons et al. (2005), including worker-specific fixed effect dramatically reduces the magnitude of the occupation effects. After controlling for fixed effects, the standard deviation of the occupation effects is smaller in performance pay jobs (0.051) than in non-performance pay jobs (0.062). This is, once again, consistent with the predictions of Section 2.

Table 6 explores the other predictions of the model about how the variance of the different components of the error term compare for performance pay and non-performance pay jobs.[9]

[9]See Parent (1999) for a related analysis with the NLSY comparing piece rate/commission workers and

The most interesting comparison is column 2 vs. column 4 of Panel B. Only "switchers" who are observed on both performance pay and non-performance pay jobs are used in Panel B. This means that the underlying variance of the person-specific component θ_i is the same for the performance pay and non-performance pay samples. As a result, the relative return to this component in performance pay and non-performance pay jobs, d_t^p/d_t^n, is equal to the square root of the ratio of the estimated variance of θ_i in performance pay and non-performance pay jobs. These variances are 0.094 and 0.044, which implies that the ratio d_t^p/d_t^n is equal to 1.46. In other words, d_t^p is 46 percent larger than d_t^n. This is very interesting since we found in Table 4 that the return to education and experience in performance pay jobs also exceeded the return on non-performance pay jobs by factor in the 40-60 percent range. Strictly speaking, the model implies that all these returns should be proportional with a factor a proportionality given by s^p/s^n. This simple model thus appears to be a parsimonious way of modelling the wage structure in performance pay and non-performance pay jobs.

Also consistent with the theoretical predictions, the results indicate that the variance of the job-specific term is much smaller in performance pay (0.009) than non-performance pay jobs (0.038). In intuitive terms, this suggests that the firm an individuals works for explains quite a bit of the wage variation in non-performance pay jobs, but much less in performance pay jobs. This provides quite convincing evidence that pay for performance is indeed a good proxy for whether wages are attached to workers instead of jobs. Finally, the variance of the "residual" or idiosyncratic term is slightly smaller in performance pay than in non-performance pay jobs. Remember, however, that the model did not have specific predictions about whether this variance should be larger in one type of job or the other.

We also present some complementary evidence from the NLSY in Table 7. As in the case of the PSID, we run separate wage regressions for performance pay and non-performance pay jobs. We also exploit the fact that the Armed Forces Qualifying Test (AFQT) score, which is available in the NLSY, can be used as a proxy for unmeasured productive characteristics. Since the AFQT score is a pure worker characteristic, as opposed to a job characteristic, its effect on wages should be larger in performance pay than in non-performance pay jobs. Table 7 confirms that both in the late 1980s and in the late 1990s, returns to productive worker

those receiving bonuses to salaried and hourly paid workers.

characteristics (education, experience, and the AFQT score) are larger in performance pay than non-performance pay jobs.

In summary, our analysis of the PSID data strongly supports the view that wages on performance pay jobs are more closely linked to productive characteristics than wages on non-performance pay jobs. Relative to performance pay jobs, wages on these other jobs depend more on the characteristics of the jobs people hold than on the productive characteristics of the individuals. The fact that the results from the NLSY where we use a different measure of pay for performance are similar to the main PSID results highlights the robustness of our main findings. The next section explores the implications of these findings for the growth of wage inequality between the late 1970s and the early 1990s.

5 Performance pay and the growth in wage inequality

In this section, we firm perform a variance decomposition that is very similar to what has been done to quantify the contribution of de-unionization to the growth in wage inequality. We then look at the impact of performance pay on broader measures of wages inequality, such as the 90-50 and the 50-10 gap. As in the case of unions, we decompose the effect of performance pay into a between- and within-group component. The between-group component, or "wage gap" effect, reflects the fact that a positive wage gap between performance pay and non-performance pay jobs tends to increase inequality. The within-group (groups being performance pay and non-performance pay jobs) component can be divided in two subterms. First, higher returns to measurable characteristics (education and experience) in performance pay jobs create more wage dispersion within the performance pay sector. Similarly, differences in the variance of the error term can also contribute to the effect of performance pay on overall inequality. This latter term could be further split up into the three error components discussed above (person-specific, firm-specific, and the idiosyncratic or residual term). Finally, we use DiNardo et al. (1996)'s procedure to adjust for differences in the distribution of measured characteristics when computing the various counterfactuals. See DiNardo and Lemieux (1997) for a very similar "reweighting" decomposition applied to unionization.

Before presenting the decomposition results, we first report some descriptive information on the trends in wage inequality to be explained. Figure 5 summarize the changes in wage inequality in our PSID data by showing the evolution of the standard deviation of wages in performance pay, non-performance pay, and all jobs between 1977 and 1996. As expected, the figure indicates a substantial increase in inequality over time. For example, Panel A of Figure 5 shows that the standard deviation of hourly wages for all jobs increased from about 0.52 in 1977 to over 0.60 in the early 1990s, before going down a bit in the 1990s. More interestingly, the standard deviation for performance pay jobs increased generally faster than in non-performance pay jobs. This pattern is even clearer in Panel B that only focuses on full-time/full-year workers. Along with Figure 2a, these results suggest that performance pay jobs are closely linked to the growth of wage inequality since 1) inequality grew faster in performance pay jobs, and 2) the growing incidence of performance pay jobs means that an increasingly large fraction of workers are employed in this more unequal sector.

The decomposition results are reported in Table 8. The decomposition is performed for all workers, but wages are weighted by the number of hours of work to get a distribution of wages representative over all the hours worked in the economy, as in DiNardo et al. (1996). As indicated at the bottom of the table, the variance grew by 0.1076 over the period considered (1976-79 to 1990-93). The question is how much of this can be attributed to the rising incidence in performance pay jobs from 0.3191 (column 2) to 0.4750 (column 5)? In terms of the three components discussed above, the between or wage gap component (row 7) increased from 0.0039 in the 1976-79 to 0.0127 in 1990-93. The within-group component associated to observables increased from 0.0095 to 0.0295 (row 3). Finally, the effect related to the variance of the error term (row 6) decreased from 0.0052 to 0.0028, offsetting in part the two other factors. We show at the bottom of the table that the three terms combined together explain 0.0264, or 25 percent, of the overal increase in the variance.

One drawback of the variance as a measure of inequality is that it summarizes the overall wage dispersion without indicating in which part of the distribution performance pay has the largest effect. As mentioned earlier, we expect performance pay to play a more important role in the top-end than in the low-end of the wage distribution, which is the precise place where there have been the largest expansion in wage inequality (Autor et al. (2006)). One advantage of the reweighting procedure used in Table 8 is that any measure of dispersion, such as the 90-50 or the 50-10 gap, can be computed in both the actual and reweighted sample. The overall effect of performance pay jobs (which combines both the between- and within-group effects discussed above) is obtained by simply contrasting the actual and counterfactual measure of wage dispersion.

Figure 6 shows the difference between the actual and counterfactual wages distribution at each wage percentile. The striking feature of the figure is that the effect of performance pay jobs is concentrated at the top end of the wage distribution. It is also clear that the effect becomes larger in the early 1990s than in the late 1970s. Figure 7 then compare the growth in wage inequality that would have prevailed with and without performance pay jobs by showing the change in real wages at each percentile in the actual (with performance pay jobs) and counterfactual wage distribution (without performance pay jobs). The figure shows that essentially all the growth in wage inequality above the 80th percentile is due to performance pay jobs. This is also confirmed in Table 9 that shows the impact of performance pay jobs on a number or inter-quantile gaps such as the 90-50 gap and the 99-90 gap.

6 Conclusion

An increasing fraction of jobs in the U.S. labor market include a performance pay component in addition to regular wages and salaries. In this paper, we look at the effect of the growing incidence of performance pay on wage inequality. The basic premise of the paper is that performance pay jobs have a more "competitive" pay structure that rewards productive characteristics of workers more than other jobs. We develop a simple model to illustrate this point and derive several testable implications. Consistent with this view, we show that compensation in performance pay jobs is more closely tied to both measured (by the econometrician) and unmeasured productive characteristics of workers. We conclude that the growing incidence of performance pay accounts for 25 percent of the growth in male wage inequality between the late 1970s and the early 1990s, and for most of the growth in top-end wage inequality (above the 80th percentile) during this period.

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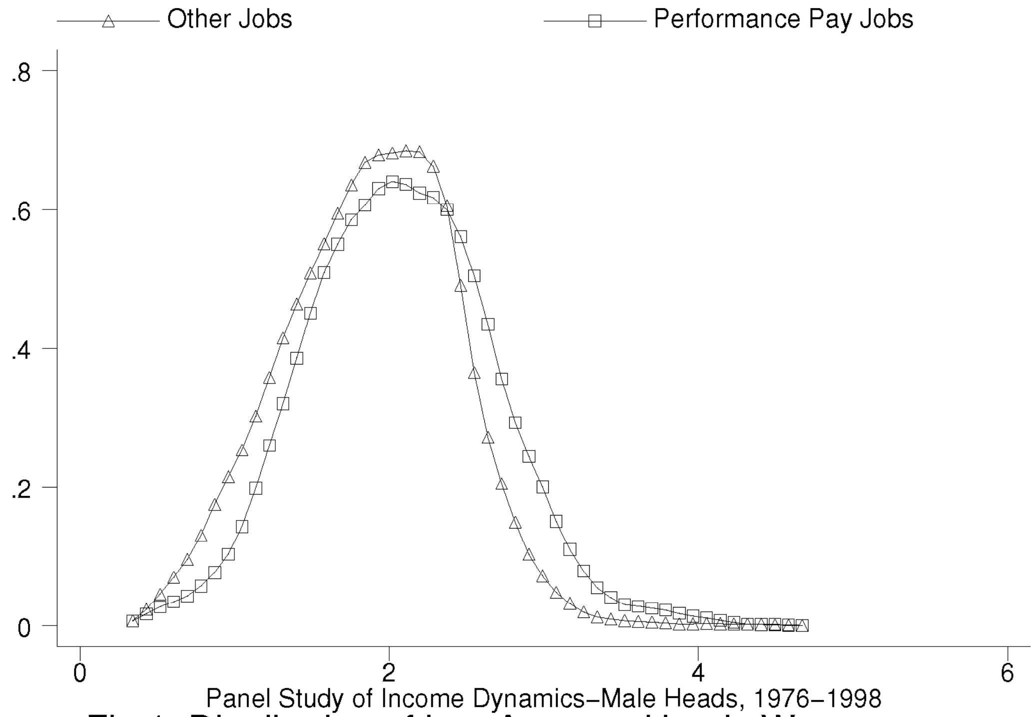


Fig 1. Distribution of Log Average Hourly Wages

Figure 2a. Performance Pay Job Incidence

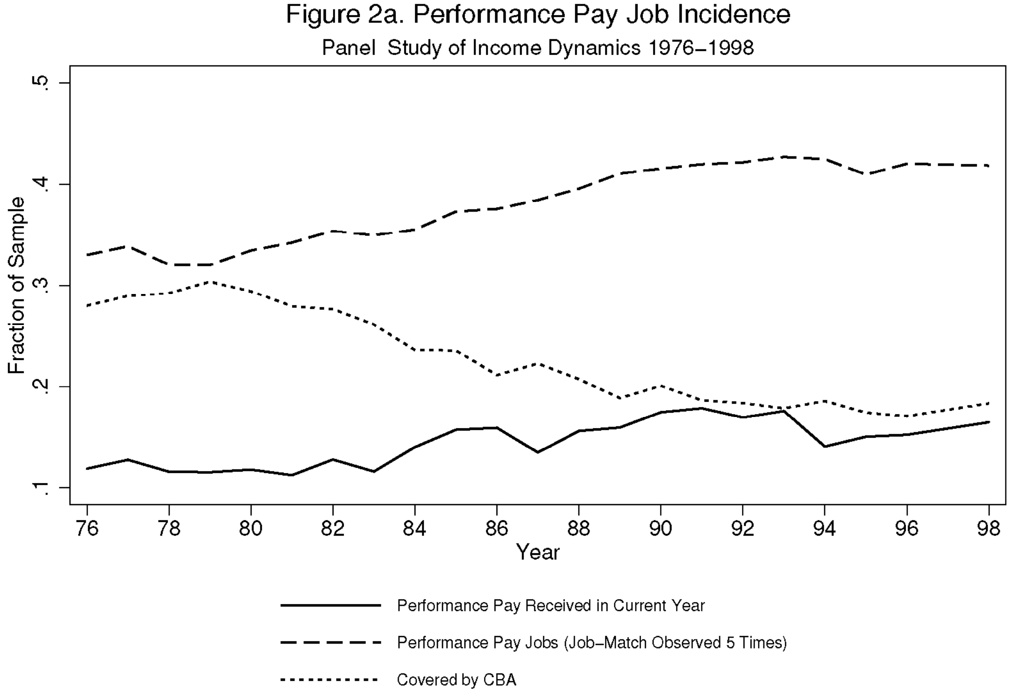


Figure 2b. Performance Pay Incidence for Hourly Paid Workers

Panel Study of Income Dynamics 1976–1998

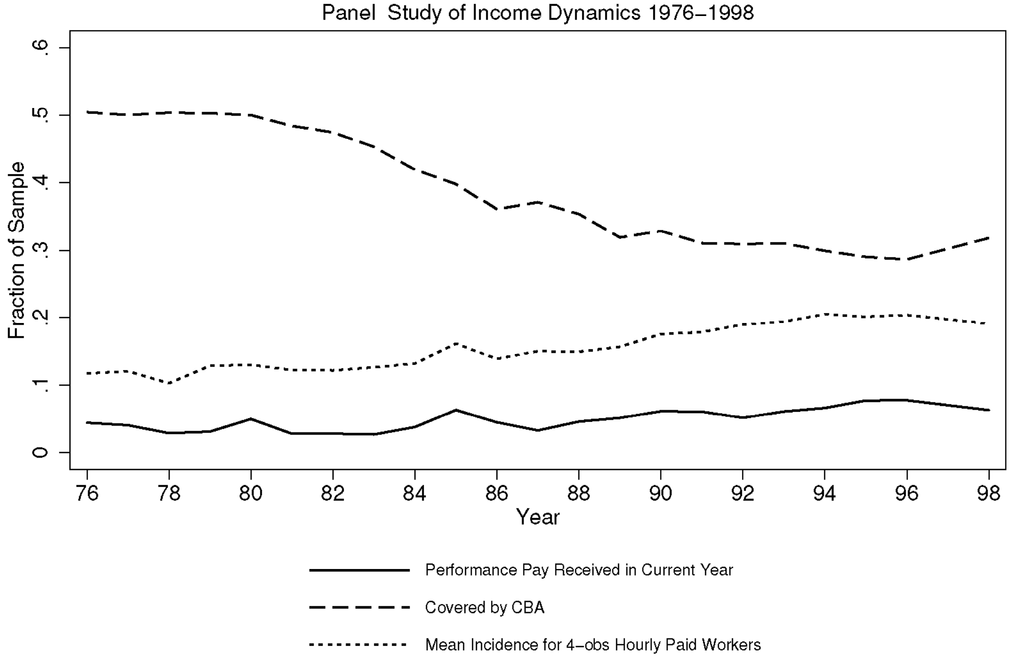


Figure 2c. Performance Pay Incidence for Salaried Workers

Panel Study of Income Dynamics 1976–1998

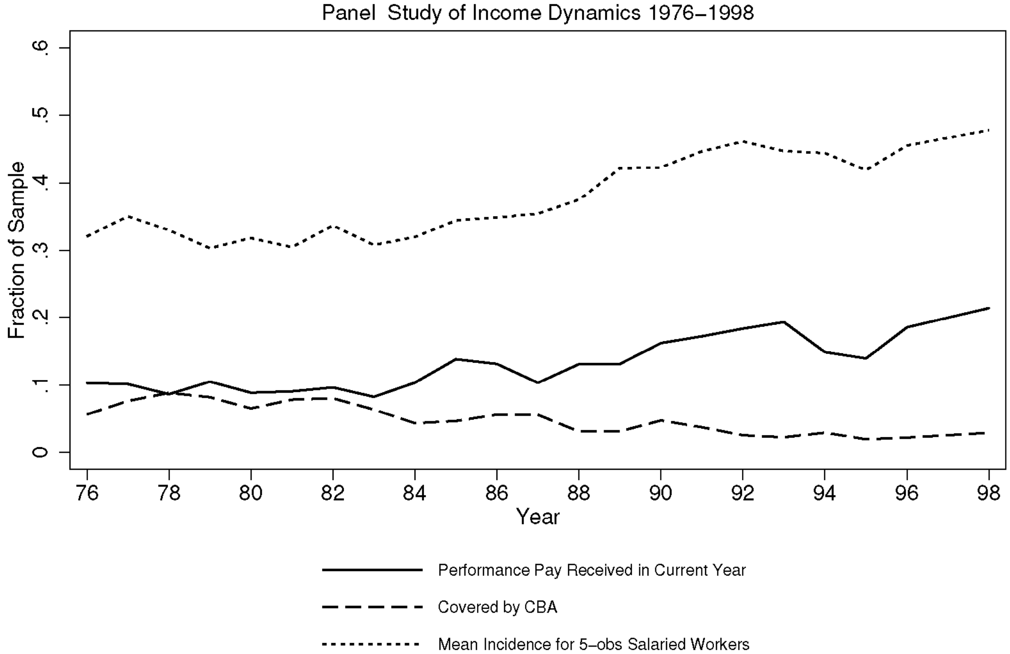


Figure 2d. Performance Pay Incidence for Union Workers

Panel Study of Income Dynamics 1976–1998

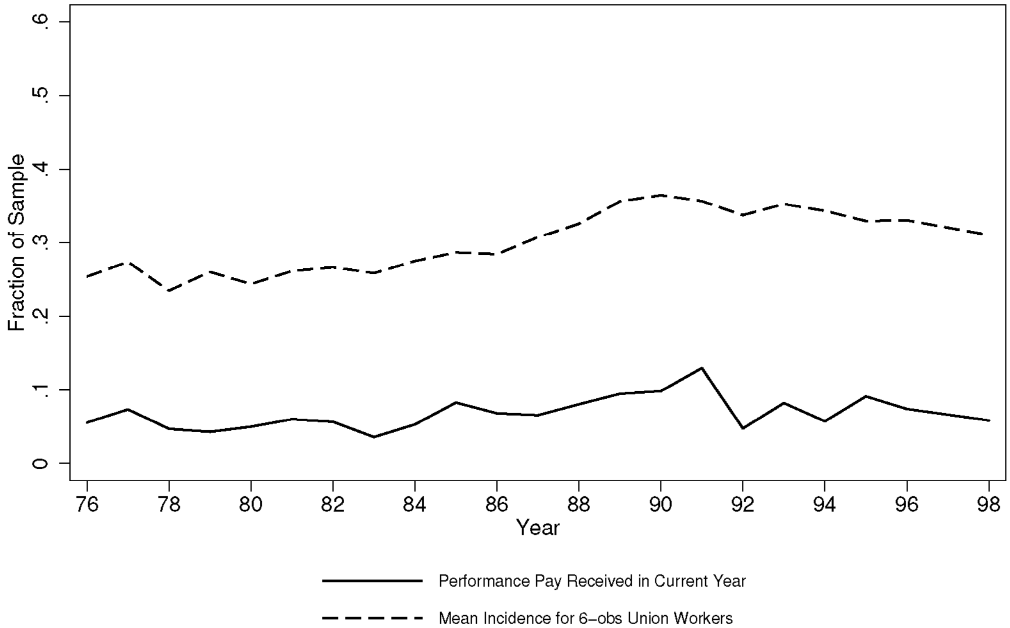


Figure 2e. Performance Pay Incidence for Non Union Workers

Panel Study of Income Dynamics 1976–1998

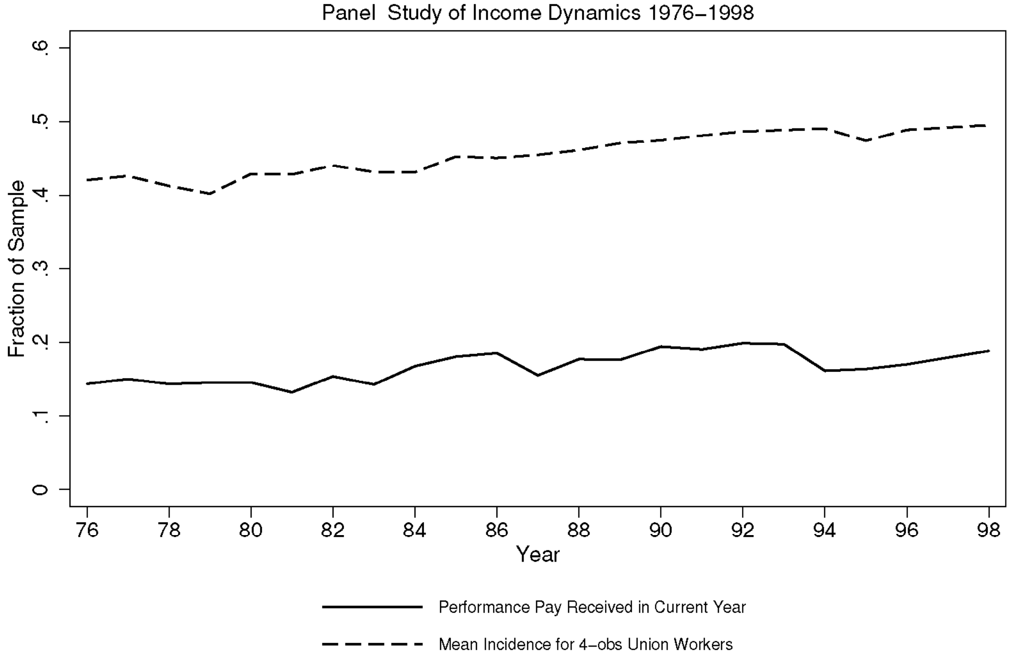
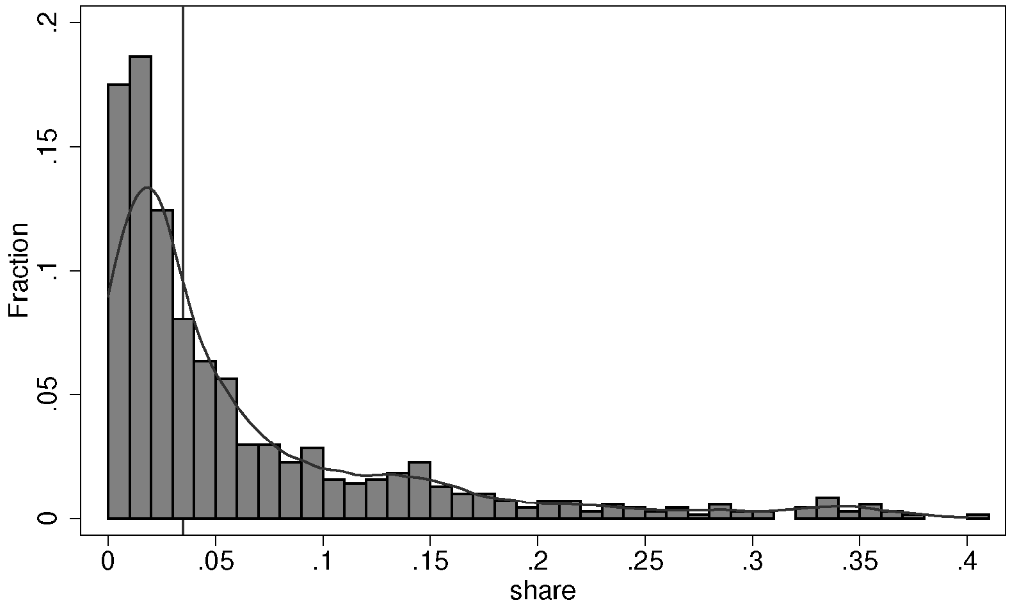


Figure 3. Share of Performance Pay in Total Earnings
PSID 1992–1998



Vertical Line Indicates Median Share (3.5%)

Figure 4. Education and Wages
Dependent Variable: Log Hourly Earnings

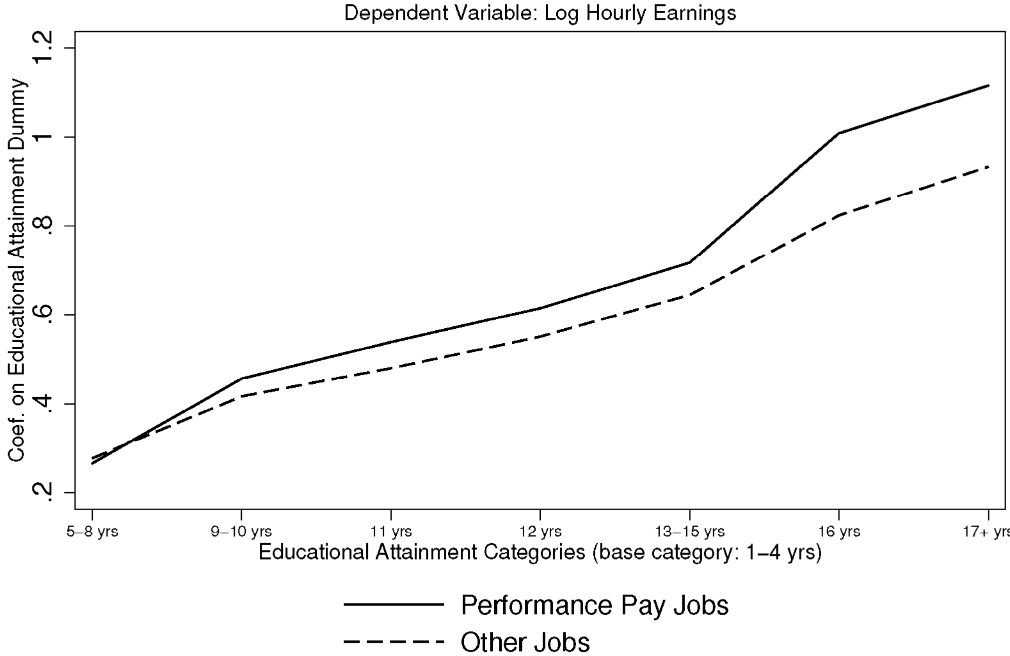


Figure 5. Wage Inequality

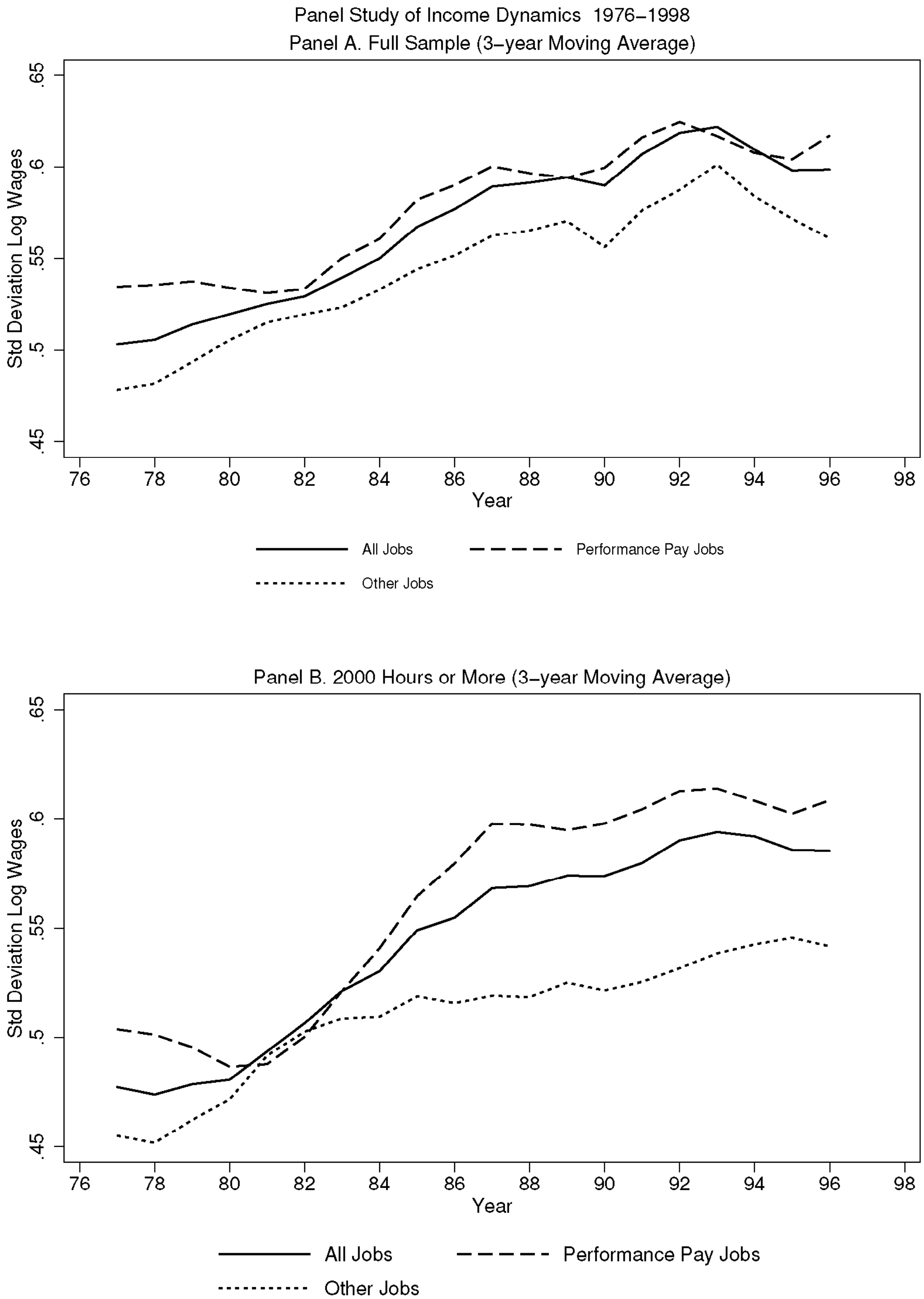
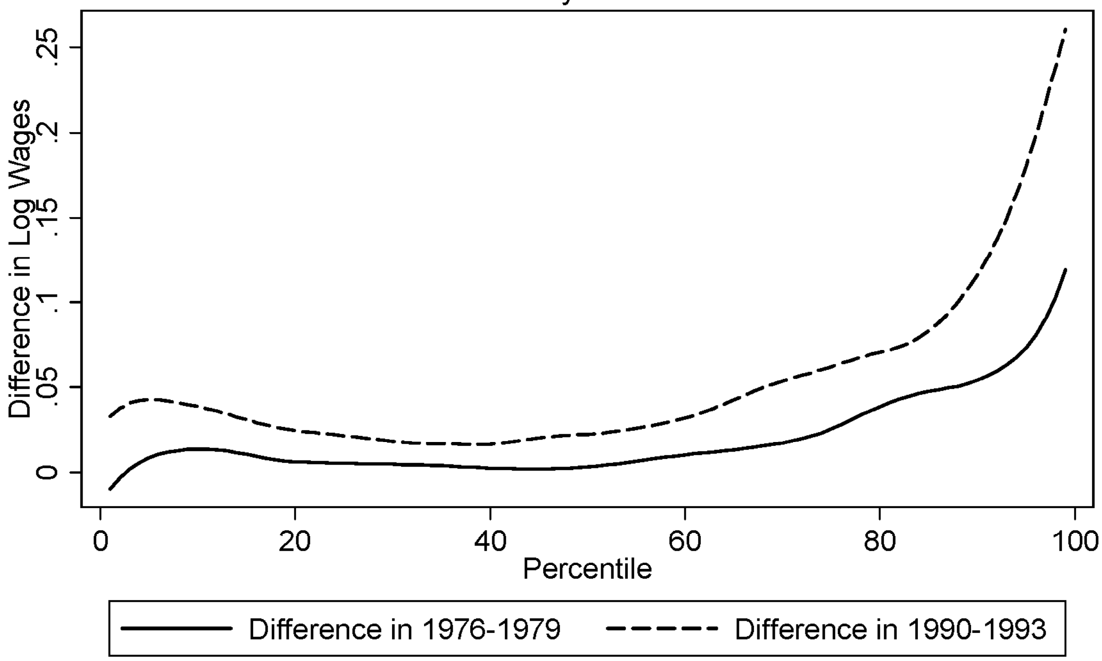
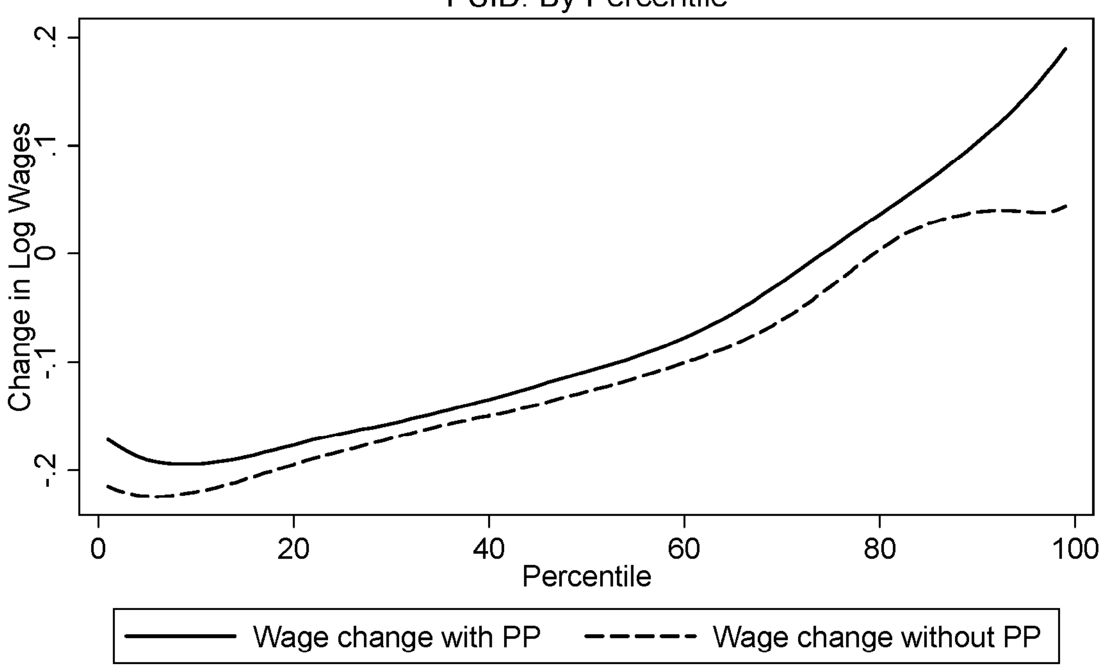


Figure 6. Change Over Time in Differences Between PPJ and Non-PPJ
PSID: By Percentile



Smoothed by Locally Weighted Regression

Figure 7. Change Over Time in Wages by Percentile with and without PPJ
PSID: By Percentile



Smoothed by Locally Weighted Regression

Table 1. Summary Statistics: Panel Study of Income Dynamics 1976-1998

	Non Performance Pay Jobs	Performance Pay Jobs
Average Hourly Earnings ($79)	8.39	10.63
Education	12.53	13.32
Potential Experience	18.76	18.81
Employer Tenure	7.61	9.15
Married	0.75	0.78
Covered by CBA	0.28	0.15
Non White	0.13	0.10
Paid by the Hour	0.65	0.32
Paid a Salary	0.32	0.50
Annual Hours Worked	2105.73	2270.46
# workers (Tot:3181)	2790	1449
# Job Matches (Tot: 8631)	6573	2058
# Observations (Tot: 30424)	19125	11299

Notes. Performance pay jobs are employment relationships in which part of the worker's total compensation includes a variable pay component, (bonus, commission, piece rate). Any worker who reports overtime pay is considered to be in a non performance pay job.

Table 2. Incidence of Performance Pay Jobs by Industry and Occupation, 1976-1998

Industry categories (1 digit)	Occupation categories (1 digit)								
	Professionals	Managers	Sales	Clerical	Craftmen	Operatives	Laborers	Services	Total
Min.& Durables	0.47*	0.60	0.00	0.36	0.19	0.14	0.11	0.00	0.23
	0.08**	0.13	0.00	0.02	0.07	0.05	0.06	0.00	0.07
Non-Durables	0.57	0.43	0.30	0.22	0.18	0.15	0.03	0.03	0.25
	0.13	0.19	0.05	0.04	0.02	0.03	0.00	0.03	0.08
Transpo., Utils	0.30	0.26	0.61	0.34	0.20	0.29	0.15	0.79	0.25
	0.06	0.06	0.15	0.09	0.04	0.09	0.01	0.10	0.06
FIRE	0.73	0.55	0.20	0.25	0.00	0.00	0.00	0.20	0.39
	0.24	0.16	0.09	0.12	0.00	0.00	0.00	0.07	0.15
Bus.,Prof. Serv.	0.34	0.54	0.46	0.30	0.28	0.15	0.00	0.04	0.30
	0.11	0.24	0.14	0.17	0.11	0.07	0.00	0.00	0.12
Personal Serv.	0.31	0.51	0.00	0.05	0.04	0.21		0.04	0.29
	0.05	0.26	0.00	0.00	0.04	0.07		0.03	0.15
Whol-Tr.& Oth Serv.	0.58	0.46	0.37	0.24	0.13	0.20	0.19	0.00	0.34
	0.14	0.14	0.17	0.02	0.12	0.14	0.19	0.00	0.13
Retail Trade	0.31	0.30	0.30	0.22	0.19	0.21	0.17	0.26	0.25
	0.10	0.11	0.19	0.08	0.10	0.03	0.00	0.18	0.11
Construction	0.66	0.24		0.00	0.11	0.12	0.23		0.14
	0.26	0.05		0.00	0.06	0.11	0.11		0.07
Total	0.43	0.44	0.35	0.27	0.18	0.17	0.14	0.15	0.26
	0.11	0.15	0.13	0.08	0.06	0.06	0.06	0.09	0.09

*%Performance Pay Jobs; **%Received either a bonus or a commission/piece rate in a given year.

Table 3. Performance Pay Jobs and Log Average Hourly Earnings
(Standard Errors in Parentheses)

Variable	Levels	Levels	Within-Worker	Within-Worker	Within-Job
			Specification		
Performance Pay Job Dummy	0.0725	0.0331	0.0262	-0.0016	-
	(0.0140)	(0.0153)	(0.0119)	(0.0124)	
Performance Pay Received in Past Year	-	0.1073	-	0.0593	0.0499
		(0.0155)		(0.0090)	(0.0060)
Industry Dummies	Yes	Yes	Yes	Yes	Yes
Occupation Dummies	Yes	Yes	Yes	Yes	Yes
Year Dummies	Yes	Yes	Yes	Yes	Yes
Number of Obs.: 30,424					

Performance job dummy=1 if either a bonus or commission/piece rate earnings are received at any time during the employment relationship; performance pay received in past year=1 if either a bonus, commissions/piece rates earnings are received in past calendar year. Other covariates are cubic functions of potential experience and tenure, the number of times a job-match is observed, years of completed schooling, calendar year average of the unemployment rate in the county of residence, and dummies for being married, nonwhite, and for union status and region of residence. Standard errors are adjusted for clustering at the job-match level.

Table 4. Skills Related Wage Differentials and Performance Pay Jobs
(Standard Errors in Parentheses)

	Specification			
Variable	OLS-PPJ	OLS-Other Jobs	OLS-Pooled	Fixed-Effects-Pooled
Performance Pay Job Dummy			-0.4371 (0.0893)	-0.2258 (0.0385)
Years Of Education	0.0092 (0.0063)	0.0657 (0.0036)	0.0632 (0.0036)	0.0093 (0.0035)
Education X Performance Pay Job			0.0360 (0.0065)	0.0176 (0.0029)
Potential Experience	0.0093 (0.0012)	0.0058 (0.0007)	0.0057 (0.0007)	-0.0027 (0.0015)
Experience X Performance Pay Job			0.0039 (0.0013)	0.0025 (0.0006)
Tenure	0.0048 (0.0016)	0.0058 (0.0009)	0.0066 (0.0009)	0.0067 (0.0005)
Tenure X Performance Pay Job			-0.0032 (0.0017)	-0.0018 (0.0008)
Number of Observations	11299	19125	30424	30424

Other covariates are the same as those in Table 3, except for the higher order terms in experience and tenure.

Table 5. Performance Pay Jobs and Interoccupation Wage Differentials
(Standard Errors in Parentheses)

	Specification			
	OLS-PPJ	FE-PPJ	OLS-Other Jobs	FE-Other Jobs
Professionnals	0.000	0.000	0.000	0.000
Managers	0.096	0.081	-0.057	-0.022
	(0.034)	(0.015)	(0.028)	(0.015)
Sales	-0.081	-0.050	-0.201	-0.069
	(0.043)	(0.020)	(0.047)	(0.022)
Clerical	-0.312	-0.025	-0.321	-0.136
	(0.048)	(0.020)	(0.026)	(0.016)
Craftsmen	-0.178	0.002	-0.216	-0.052
	(0.033)	(0.017)	(0.024)	(0.014)
Operatives	-0.359	-0.039	-0.329	-0.104
	(0.038)	(0.019)	(0.026)	(0.015)
Laborers	-0.365	-0.054	-0.397	-0.117
	(0.052)	(0.024)	(0.031)	(0.017)
Service Workers	-0.369	-0.090	-0.490	-0.189
	(0.054)	(0.027)	(0.030)	(0.017)
Standard Deviation of Occupation Dummies	0.184	0.051	0.166	0.062
Number of Observations	11251	11251	19173	19173

Other covariates are the same as those in Table 4. Standard errors are adjusted for clustering at the job-match level.

Table 6. Error Component Models by Type of Job
(Standard Error in Parentheses)

Panel A: Full Sample

Parameter	Bonus Pay Jobs [1]	Bonus Pay Jobs [2]	Non Bonus Pay Jobs [3]	Non Bonus Pay Jobs [4]
Variance of Worker Component	0.107 (0.001)	0.099 (0.004)	0.072 (0.001)	0.056 (0.001)
Variance of Job-Match Component	-	0.010 (0.003)	-	0.027 (0.003)
Variance of Residual Term	0.093 (0.002)	0.092 (0.003)	0.114 (0.002)	0.102 (0.002)
# Workers	1438	1438	2792	2792
# Cross-Products	74672	74672	118411	118411

Panel B: Workers Who Worked in Both Types of Jobs

Parameter	Bonus Pay Jobs [1]	Bonus Pay Jobs [2]	Non Bonus Pay Jobs [3]	Non Bonus Pay Jobs [4]
Variance of Worker Component	0.101 (0.001)	0.094 (0.003)	0.061 (0.002)	0.044 (0.002)
Variance of Job-Match Component	-	0.009 (0.004)	-	0.038 (0.003)
Variance of Residual Term	0.095 (0.003)	0.094 (0.003)	0.126 (0.004)	0.105 (0.004)
# Workers	1049	1049	1049	1049
# Cross-Products	41690	41690	26714	26714

Unweighted covariance structure models are fit to the cross-products of the residuals of an OLS regression of log wages on the same set of covariates used in previous tables.

Table 7: Skills Related Wage Differentials and Performance Pay Jobs
in the NLSY (Standard Errors in Parentheses)

	1986-88		1996-2000	
Variable	PP jobs	Other jobs	PP jobs	Other jobs
Years of Education	0.0700	0.0550	0.0960	0.0750
	(0.0060)	(0.0030)	(0.0080)	(0.0040)
Potential Experience	0.0470	0.0440	0.0430	0.0280
	(0.0050)	(0.0020)	(0.0040)	(0.0020)
AFQT score (/10)	0.0420	0.0330	0.0530	0.0440
	(0.0050)	(0.0030)	(0.0070)	(0.0030)
Number of Observations	1553	4726	1053	2870

Table 8. The Contribution of Performance Pay Jobs (PPJ) to the Variance of Log Hourly Earnings
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WEIGHTED BY HOURS WORKED, CONTROLLING FOR NUMBER OF TIMES JOB IS OBSERVED

	[1]	[2]	[3]	[4]	[5]	[6]
		1976-1979			**1990-1993**	
Wage Compression/Expansion Between Groups of Workers	Actual Variance	Variance w/o Performance Pay Jobs	Performance Pay Job Effect	Actual Variance	Variance w/o Performance Pay Jobs	Performance Pay Job Effect
	Fraction of PPJ	0.3191		Fraction of PPJ	0.4750	
1. Var(XB | PPJ=1)	0.1302	0.1003	0.0299	0.1935	0.1313	0.0622
2. Var(XB | PPJ=0)	0.0995	0.0995	0.0000	0.1322	0.1322	0.0000
3. Average Between-Group Variance: (%PPJ*row 1 + (1-%PPJ)*row 2)	0.1093	0.0998	0.0095	0.1613	0.1318	0.0295
Wage Compression/Expansion Within Groups of Workers						
4. Var(e | PPJ=1)	0.1434	0.1272	0.0162	0.1823	0.1765	0.0058
5. (Var(e | PPJ=0)	0.1266	0.1266	0.0000	0.1756	0.1756	0.0000
Total Within-Group Variance						
6. Var(e): (%PPJ*row 4 + (1-%PPJ)*row 5)	0.1320	0.1268	0.0052	0.1788	0.1760	0.0028
Wage Gap Effect						
7. %PPJ*(1-%PPJ)*(Δ_hat2 - (Δ_hat - Δ)2)	0.0039	0.0000	0.0039	0.0127	0.0000	0.0127
Overall Variance of Wages						
8. Var(Xb + e): (row 3 + row 6 + row 7)	0.2452	0.2265	0.0186	0.3528	0.3078	0.0450

Change in Overall Variance (col. 4 – col. 1): 0.1076
Change in Performance Pay Job Effect (col. 6 – col. 3): 0.0264
Share of Performance Pay Job Effect: 24.52%

Notes. 1Computations for the counterfactual variances (columns 2 and 5) done using the weighting methodology in DiNardo-Fortin-Lemieux to produce the counterfactual predicted wage for performance pay job workers. Δ_hat2 refers to the squared value of the actual mean difference between performance pay job workers' log wages and non performance pay job workers' while (Δ_hat – Δ)2 is the squared difference between the actual mean difference and the difference in the returns (the B's) across both types of jobs evaluated at the average value of performance pay job workers' X's.

Table 9. Other Measures of Hourly Earnings Dispersion (PSID)

	1976-79			1990-93		
Gap	Actual dispersion	Dispersion w/o PP jobs	Effect of PP jobs	Actual dispersion	Dispersion w/o PP jobs	Effect of PP jobs
50-10	0.676	0.697	-0.021	0.771	0.775	-0.004
75-50	0.285	0.263	0.022	0.394	0.363	0.031
90-50	0.551	0.511	0.040	0.751	0.706	0.045
90-75	0.266	0.247	0.018	0.357	0.343	0.015
95-90	0.197	0.185	0.012	0.234	0.145	0.088
99-75	0.889	0.761	0.128	1.113	0.820	0.293
99-90	0.624	0.514	0.110	0.755	0.477	0.278
99-95	0.427	0.329	0.098	0.522	0.332	0.189

Sample sizes: 5261 for 1976-79 sample and 5665 for 1990-93 sample.