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Is There a Wage Payoff to Innovative Work Practices?

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INTRODUCTION

In the last twenty years, the wages of less skilled workers have fallen and wage inequality has risen to a degree unprecedented in the post-war United States (Katz and Murphy 1992; Levy and Murnane 1992; Gottschalk and Smeeding 1997). The widely shared affluence of the post-war period was built in part on low to medium skilled jobs that paid relatively high wages despite their Taylorized character, often due to the direct or indirect effects of unions. Though the precise extent to which the changes in earnings inequality are attributable to various causes is still being debated (Katz and Autor 1999), it is evident that the decline of these jobs has been partly responsible for the reversals of the last twenty years among those without a college education. In the language of segmented labor markets theory, the number of jobs in the secondary labor market, such as those in low-wage services, have expanded and secondary labor market principles, such as more vigorous union avoidance efforts, have intruded into the lower primary segment (Harrison and Bluestone 1988; cf. Edwards 1979; Gittleman and Howell 1995). The result has been described as a scarcity of "good" jobs for less skilled workers and a growth of "bad" jobs (Loveman and Tilly 1988).

While there is widespread acknowledgment that the combination of high wages and routine jobs is unlikely to return, many argue that secondary jobs for those at the bottom are the only option. In this view, a new high wage model of employment for less skilled workers is possible. Rather than pursuing a "low road" employment strategy based on low skills and low wages, employers can adopt another employment paradigm, a "high road" strategy involving significant workplace reorganization, more skilled and interesting jobs, and greater employee involvement in organizational decision making. This model has come to be called high performance because it is also believed to raise productivity and improve firm competitiveness (National Center on Education and the Economy 1990). Appelbaum and Batt summarize this new view: "Despite the obstacles some firms have succeeded in becoming high-performance workplaces...these companies are the best hope American workers have for middle-class opportunities–good wages, employment security, and interesting work" (1994, p.13). By increasing the skills and wages of less skilled workers, high performance work practices, it is hoped, may also help reduce wage inequality.

Yet while there is considerable optimism in some quarters that the so-called high performance workplaces can significantly improve workers' wages, there are few studies that actually try to determine whether they do so. The present study addresses this question using a unique data set drawn from a nationally representative sample of establishments and their workers containing information on both the presence of high performance and related management practices and workers' wages and background characteristics. Thus, we are able to directly address the issue of whether workers in establishments with innovative practices are, in fact, paid more than their counterparts at traditionally-managed firms.

The rest of the paper is structured as follows. The first section defines high performance work, discusses issues associated with modeling its relationship to workers' wages, and reviews the existing literature on the subject. The second section describes the data. The third section presents results and a final section concludes. In general, the analyses do not provide much consistent evidence that high performance work practices raise workers' wages.

HIGH PERFORMANCE WORK AND WAGES

Defining High-Performance Work Practices

There is no precise or consensus definition of high performance work and none is likely to satisfy everyone but most will agree it involves a number of characteristics. First, job tasks in high performance workplaces have greater variety and skill than traditional Taylorized jobs, often involving formal job rotation schemes and delegation of some craft, supervisory, human resource, and record keeping tasks to less skilled workers. Second, employees participate in problem solving and organizational decision making, particularly through formal teams and in the area of quality improvement. Finally, these practices are often supported by non-traditional compensation systems, such as pay for skills mastered on the job, performance bonuses, productivity gain sharing, and profit sharing, which reward skill acquisition and participation in productivity improvement, rather than fixed pay based on job title, position, or seniority. These policies are believed to reverse the extreme fragmentation of tasks and hierarchical division of labor that characterized the Scientific Management approach to work organization and employment relations.

Some other new management practices examined below and often discussed with the preceding are more ambiguous from this perspective. Traditionally, manufacturing workers relied on their ability to accumulate buffer stocks of work in progress as a way to gain some control over their work pace (e.g. Burawoy 1979). Some argue that just-in-time inventory systems, which eliminate such buffer stocks to reduce inventory costs, lead management to promote worker involvement in quality and process improvement to avoid interruptions in workflow, which are more costly without a large inventory to buffer unanticipated drops in output (Piore 1989). Others argue that just-in-time is simply a technique to speed up production and prevent workers from banking parts and achieving some control over their work pace and thus an intensification of traditional Scientific Management strategies (Graham 1993).

Other management practices examined below, such as total quality management (TQM), are less subject to scholarly contention about their impact on job content but are also ambiguous in their implications for workers, since the substance that falls under this rubric is not always clear or consistent from case to case, may involve various other innovative practices, and may focus more on improving customer relations rather than specifically increasing the skill content of job tasks (Hackman and Wageman 1995; Wood forthcoming).

Impact on Wages

Given the character of high performance work practices, the question then becomes why one would expect to observe a positive association with workers' wages. Surprisingly, there has not been strong development of theory around this question despite its centrality to the "high road/low road" debate, but a number of possible mechanisms are clearly implicit in the literature. Many believe that high performance work practices achieve productivity gains which may be shared by effectively tapping into the large existing stock of knowledge which workers have accumulated through their experience over time and unleashing workers' creativity in solving problems (Zuboff 1988; Walton 1985). Since this requires high levels of worker cooperation, such firms might also pay an above-market "efficiency wage" as a form of gift exchange to elicit such cooperation (Akerlof 1982). Since high performance work practices are associated with increased firm-based training, it is also possible that high performance practices raise wages because firms using them develop workers' skills where they did not exist before and workers are rewarded for their increased productivity. One might also expect high performance workplaces to pay higher wages because they include practices which explicitly aim to improve pay through productivity gain sharing, bonuses, or profit sharing. Tying pay to productivity clearly has the potential to motivate workers to increase their output, though the actual benefit will depend on whether firm performance actually improves and whether gains are actually shared with workers rather than substituting for base pay.

Finally, it is known that many high performance organizations use relatively rigorous employee screening and selection procedures, including pre-employment tests, extensive interviews, and team exercises, believing them to be important to the organization's success (Murnane and Levy 1996, pp.22ff.; Florida and Kenney 1991, p.388). To the extent that high performance workplaces cream the labor market, any higher wages they pay might simply reflect differences in their workforces, whose members might receive higher wages even if they worked in a traditional workplace. In addition, it is possible that firms that already pay high wages may be more likely to adopt high performance work practices because they can afford the luxury to experiment, are more in touch with the latest management thinking, or more apt to adopt favorable policies toward their work force in general. Under these conditions, one might expect to observe an association between high performance work and wages, but the relationship would reflect various kinds of selection effects rather than a genuinely causal relationship.

There are also reasons for not expecting to observe much of a wage payoff to high performance work practices. It is not clear how large are the typical changes in the skill content of job tasks and work organization in most organizations that adopt these practices. It is quite possible that they are relatively modest and employees may already have or easily obtain the skills necessary to meet any new skill demands (Cappelli and Rogovsky 1994; Cappelli 1996). The larger literature on productivity gains associated with innovative work practices generally use unrepresentative samples and have difficulties controlling for non-random factors that affect adoption of practices which may be driving the association with productivity (Becker and Huselid 1998; Ichniowski *et al* 1996; Kling 1995). Even in cases where there are significant changes in the workplace and associated productivity gains, workers may not have the power to force management to share those gains given the decline in labor's power over the last twenty years. In these cases, the various forms of contingent pay, such as gain sharing and profit sharing, may substitute for base pay rather than supplement it.

Finally, survey data may contain various kinds of measurement error in the measurement of high performance work practices which bias coefficients toward zero. As in the case of selection effects, the estimates in this case would reflect more a limitation of the data than the nature of the relationships that actually obtain in the world.

It should also be said that while the main focus of this paper is the wage payoff to high performance work practices, the ultimate concern of many who advocate this "high road" approach to work reform is wage inequality (Bluestone and Bluestone 1992). Even if high performance work practices raised wages, the relationship between that wage effect and overall inequality is à priori indeterminate. If one believes that the recent growth of inequality is due to a rising demand for skills that the lower segment of the labor force cannot meet, then raising skill requirements even further through workplace reforms may only worsen the problem. Alternatively, even if any wage impact disproportionately benefits less skilled workers and thus reduces inequality across skill groups, the uneven diffusion of such practices may increase within-group inequality. The net impact depends on which effect dominates (see, e.g., Freeman and Medoff 1984 on the equalizing and disequalizing effects of unions).

Previous Research

While there is not a complete absence of research on the question of the relationship between high performance work practice and wages, surprisingly little work has been done in this area despite its importance in the debate over how to improve the nation's employment prospects for less educated workers and reduce inequality.

The results from the little work that has been done on the wage payoffs to high performance work practices have been mixed. A qualitative study of six retail firms finds modest effects on skill levels and little pressure to pay higher wages after introducing innovative practices in this generally low wage industry (Bailey and Bernhardt 1997). Using data from a national survey, Osterman (1994) does not that "high performance work organizations" pay efficiency wages, defined as wages above those in other establishments for comparable workers in the same industry and geographic area.[1] Using a second wave from the same survey, Osterman (1998) is also unable to detect a significant relationship between the presence of high performance work systems in 1992 and whether workers received a wage increase five years later.

On the other hand, other surveys find positive wage effects. One national survey of employees found over a third of those participating in employee involvement programs report receiving a pay raise as a consequence of their participation, though the magnitude of the increase is not asked (Freeman and Rogers 1994). Studies by Cappelli (1996, 1998) using a representative sample of establishments find the presence of Total Quality Management (TQM) is associated with higher annual earnings for production workers (6.7%), but has no effect on the wages of clerical workers. Each additional percentage of workers in self-managed teams is also associated with 0.1% higher earnings for production workers. However, neither teams nor TQM are associated with reductions in differentials between production workers and supervisors within organizations, suggesting no effects on within-plant inequality (Cappelli 1996, p.149f.). A large survey study of retail bank branches found a 5% wage differential associated with the presence of quality circles, which rose to about 9.5% in more automated branches (Hunter and Lafkas 1999).

Given the small number of studies on this subject, most with rather limited measures of high performance work practices and somewhat contradictory results, there is a great need for further research with better data. We hope to shed light on whether high performance work practices are associated with higher wages using a nationally representative dataset that has important advantages over others used in previous work, including information on a broader range of workplace practices, hourly wages at the employee level, as well as average establishment wages, and a wide range of background characteristics at the employee level that serve as controls.

DATA

The data for this study is from the Survey of Employer-Provided Training for 1995 (SEPT95), conducted by the U.S. Bureau of Labor Statistics (BLS). The survey is a nationally representative sample of nonagricultural private

establishments with fifty or more employees, which accounted for over 57 percent of private employment in the first quarter of 1995.[2] BLS surveyed 1,433 establishments and obtained usable responses from 1,062, a response rate of 74.1 percent.

In addition to a set of items on establishment training practices, the SEPT95 survey contains a number of items on high performance and related practices, which will serve as the independent variables of substantive interest in analyses below. An advantage of the SEPT95 survey is that it covers a broader range of workplace practices than existing studies. The items can be divided into three broad categories, those which relate to a job's skill content and participation in decision making, those relating to compensation, and other innovative management practices often mentioned in the same context as those in the first category but different enough to be considered separately. All variables are binary indicators of the presence/absence of a given practice at the time the survey administered in 1995. Variable definitions are given below, adapted from the SEPT95 questionnaire.

Skill and Participation

1. *Job rotation* –a work system where employees rotate among different jobs.
2. *Job redesign/reengineering* –a work system designed to increase worker performance and job satisfaction by increasing skill variety and worker autonomy.
3. *Quality circles* –voluntary groups of workers that meet regularly to solve problems concerning people and productivity.
4. *Self-directed work teams* –small groups of workers who have authority to determine internal processes to generate a specific group product, service, or decision.
5. *Peer performance review* –a performance appraisal system in which evaluations are made at least in part by co-workers.
6. *Employee involvement (EI) in technology/equipment purchase decisions* –an organizational policy in which employees have a say in purchasing decisions that affect them.

Compensation

7. *Pay for skill* –a compensation system in which pay is linked to mastery of new skills, rather than to a particular job.
8. *Profit sharing* –a plan in which shares of company profits are distributed to employees.

Other Management Practices

9. *Total quality management (TQM)* –a management approach whose principles include doing things right the first time, striving for continuous improvement, and understanding and meeting customer needs.
10. *Just-in-time inventories (JIT)* –a method of inventory control and production management which involves keeping small amounts of supplies on hand, which are received "just in time" to fill current orders.

The dependent variable for one set of models to be estimated below is the log of the average establishment wage, defined as total payroll in the fourth quarter of 1993 divided by the average number of employees for that quarter.[3] These models include dummy variables for establishment size, industry, presence of a labor union, and region and variables for the percentage of part-time workers and the establishment's occupational distribution as controls.[4] These models test whether establishments that implement high performance and other innovative work practices pay higher wages on average, controlling for background characteristics.

While the other studies described earlier only have information to estimate these kinds of establishment-level models, the SEPT95 survey also randomly sampled individual employees within each establishment. Establishment-level models can only model wages averaged over the establishment as a whole or by occupation group and control for human capital and employee characteristics only through workplace averages, but the employee questionnaires allow us to run a parallel set of employee models controlling for a more detailed set of background variables at the individual level, which is unique in the current literature. These models regress the log of the individual employee's hourly wage on the high performance practices and controls for the individual's education, age and its square, tenure and its square, sex, race/ethnicity, occupation, part-time status, and tenure, as well as the establishment size, presence of a labor union, region, and industry. Unfortunately, the employee survey did not ask whether the individual personally participated in the practices of interest, so these models test whether individuals in establishments with high performance and other innovative work practices earn higher wages after controlling for a detailed set of individual and establishment characteristics.

SEPT95 sampled two individuals within each establishment and of the 2,124 potential employees from the 1,062 responding establishments, 1,074 usable employee questionnaires were collected, a response rate of 50.6 percent.

For further details on SEPT95, see Frazis, Gittleman and Joyce (1999).

RESULTS

Basic Findings

Table 1 presents basic descriptive information on the relative prevalence of the ten workplace practices. The first column presents figures for all establishments and the second for establishment with at least 65 percent of workers in production and service occupations, since the existing literature expects these practices to have diffused mostly within blue collar production settings (Appelbaum and Batt 1994, pp.98ff.). In general, the figures in the second column are not consistent with this view. However, consistent with Gittleman, Horrigan, Joyce (1998), the incidence rate for almost all the practices is greater for manufacturing than for the remaining industries (results not shown).

The third column presents estimates of the proportion of employees who work in establishments with such practices and the fourth column restricts the sample to production and service employees. Again, restrictions on the basis of occupation tend not to result in large differences relative to the larger sample, though the figures in the third and fourth columns tend to be higher than those in the first two, reflecting the fact that most of these practices are more likely to be found in large establishments. However, in general, figures in all columns indicate a relatively high incidence of high performance work practices, though below 50% in most cases. These figures are in the same general range as similar surveys, though differences are great enough to warrant some concern over the reliability with which the practices are measured. We return to this issue below.

Table 2 presents basic regression results. The four columns correspond to the same establishment and employee samples used in Table 1. Each practice was entered separately into the establishment and employee models described in the previous section.[5] Each coefficient in Table 2 represents the effect of a given practice on wages controlling for establishment or employee characteristics, but not controlling for the other practices.[6]

The literature argues that high performance practices are complementary and best adopted as a group or in bundles rather than piecemeal (Bailey 1993; Ichniowski, et al. 1996; Appelbaum and Batt 1994), though there is not always a clear statement of which practices must be in the group or the nature of the bundles and case studies and cluster analyses of survey data have generally failed to find strong patterns of practices adopted in combination empirically (Osterman 1994; Appelbaum and Batt 1994). However, some studies find a greater likelihood of productivity gains where there is bundling (e.g. MacDuffie 1995; Ichniowski, Shaw and Prennushi 1997). We test for this possibility with respect to wages using two scales in Table 2 and a series of interaction models, discussed below. The first scale is a simple sum of the number of practices (α =.72 for establishments, α =.69 for employees), while the second uses principal component analysis to extract a factor measuring the extent of adoption of these practices.

The results in Table 2 do not suggest that workplace practices have a consistent positive effect on wages. Of the forty-eight models represented by the coefficients in Table 2, high performance work practices are significant and positive in only nine instances and in no case is the same variable significant in all four models or significant in corresponding establishment and employee models (i.e., Columns 1 and 3 or Columns 2 and 4).

For the variables that are significant in the sample of all establishments, peer performance review is associated with average wages that are 17% higher than otherwise and profit sharing is associated with a 9% wage differential (Column 1). Among establishments with predominantly production and service employees, peer review is associated with a 10% wage differential, profit sharing is associated with a 11.7% wage differential, and self-directed teams are now associated with a 7.7% wage differential, while job rotation is now associated with wages that are 7.2% lower than those at otherwise similar establishments (Column 2).

Among all employees, it is now quality circles that are associated with higher wages (8.4%), while job rotation is again associated with lower wages (-6%) (Column 3). When the sample is restricted to production and service workers, quality circles are also associated with higher wages (14%) and the job rotation coefficient has a similar magnitude as in the full sample but is no longer significant (Column 4). In this subgroup, TQM is also now associated with wages that are 10.3% higher and job redesign is associated with wages that are 8.5% lower than otherwise similar workers.

Turning to the models using the number of practices as a measure of bundling, in none of the four specifications is simply having more practices associated with higher wages. Models using weighted scales derived from principal components analysis do not show any improvement over the simple additive scale in providing evidence for positive wage payoffs to high performance practices.

In general, the pattern of results reported above is not altogether easy to explain but the broad absence of significant positive effects strongly suggests that high performance work practices do not have positive effects on wages in most cases. In addition, though there are some differences between the full samples and those focused on production

and service work (Column 1 vs. Column 2 and Column 3 vs. Column 4), the evidence provides little support for the view that non-supervisory workers benefit more from the presence of the practices than other employees.

For only three variables is it the case that a variable is significantly positive for the full sample and its corresponding subsample, peer review and profit sharing on the establishment side and quality circles on the employee side. Of these, peer performance review is the most surprising, as it is not a practice that one would expect to have especially strong impacts on skills and productivity relative to most of the others and the coefficient seems implausibly large in the establishment-level models. It is possible that the large effects for this practice may reflect the fact that peer review, which has relatively low incidence (see Table 1), is only implemented in establishments with deep commitment to high performance principles. If the peer review indicator is proxying for whether an establishment is "truly" high performance, then this may explain the large effect observed for this variable.[7] Nevertheless, if this is the case, it is unclear why the results do not carry over to the employee-level models. Alternatively, it is possible that adoption of this practice is more likely in establishments that already pay high wages. The explanation for why the results do not carry over to the employee side seems to be differences in the composition of the samples, as the coefficients are no longer significant when the establishment sample is restricted to cases present in the employee sample (results not shown).

Compared to peer review, it seems more plausible that profit sharing and quality circles would be associated with genuine wage effects, especially as there is evidence that profit sharing raises firm-level productivity (e.g., Kruse 1992). Even so, the lack of consistency between the establishment- and employee-level models warrants caution in interpreting the profit sharing and quality circle results in causal terms. Unlike with peer review, the inconsistencies between the establishment- and employee-level results in these cases do not disappear when the establishment sample is restricted to cases where data on individual employees are available (results not shown).

It is not possible, unfortunately, to gain a further sense of the fragility of these results by comparisons with other studies, since there are no others of which we are aware that consider these three practices individually. Of the entire group of 10 practices, however, two are examined by Cappelli (1998) using establishment-level data. As noted, he finds that TQM is positively associated with higher wages for production workers, as well as most other occupational groups. TQM was also related to the wages of production and service employees in our data, but not to wages in any of the three other samples. Cappelli (1998) also found that supervisors, production workers and clerical workers earn higher wages in firms where a higher proportion of non-managerial employees are in self-managed teams, whereas in SEPT95 teams are only significant in the sample of establishments dominated by production and service workers.

Interaction Models

It is possible that the general weakness of the results in the previous section reflects the use of binary indicators to measure high performance practices, which can cover different proportions of the workforce within establishments and can vary across establishments in the seriousness with which the policies are actually implemented.

One way to more systematically control for whether an establishment actually has a serious program or an individual employee personally participates in it, is to use information provided in the SEPT data on communication training. This item asks employers whether they provided "communications, employee development, and quality training" in the last twelve months, where this is defined as "training in public speaking, conducting meetings, writing, time management, leadership, working in groups or teams, employee involvement, total quality management, and job reengineering." The employee survey asked workers whether they had ever received such training from their current employer. While this category of training encompasses more than just training specifically to support high performance work practices, it clearly includes such training to a significant degree. One might expect that this variable would help distinguish between those establishments that are truly committed to high performance practices or are implementing them in appropriate bundles, which includes supportive training, and those which are not. The employee version of this variable presumably helps differentiate between workers in an establishment who actually participate in high performance practices and those who do not. Interaction models using this training variable also test whether high performance work practices are most effective when bundled with complementary practices. As with the work practices variables, the training variable is a binary indicator of whether or not training was provided by the establishment or received by the employee.

Table 3 presents results of models in Table 2 reestimated after including interactions between the ten practices and the training variable, as well as a main effect for the training variable itself. If, as hypothesized in the literature, communication training is complementary to the practice, then the coefficient on the interaction term should be positive. Since there is high collinearity between the two main effects and the interaction term, the individual coefficients rather unstable so results are presented as a series of contrasts between cases for which both the practice and the training were present and cases in which either neither one was present (Columns 1 and 4), only the training was present (Columns 2 and 5), or only the practice was present (Columns 3 and 6).

More formally, if each interaction model yields the following coefficients:

b_1 = effect of high performance practice

b_2 = effect of training

b_3 = effect of high performance practice * training

then the effects of having both the practice and the training relative to neither is ($b_1+b_2+b_3$), entered in Columns 1 and 4 for the establishment- and employee-level models respectively. These effects indicate whether high employer commitment to or worker participation in high performance practices is associated with higher wages relative to the absence of both. These columns provide the clearest contrast between establishments and individuals most and least committed to or exposed to high performance work practices.

The effects of having both the practice and the training relative to having the training only is ($b_1+b_2+b_3-b_2$) or (b_1+b_3), entered in Columns 2 and 5. These effects indicate whether among establishments providing or individuals receiving training, wages are higher when a high performance practice is in place. These columns present a stricter test of the positive effects of the innovative practices, as the level of training is held constant. Positive and significant results in these columns in cases where the corresponding coefficient in Table 2 was not significant support the bundling hypothesis and suggest that communication training must be in place in order for there to be a wage payoff to the practice under consideration.

Finally, the effects of having both the practice and the training relative to having the practice only is ($b_1+b_2+b_3-b_1$) or (b_2+b_3), entered in Columns 3 and 6. These effects indicate whether at establishments with a practice in place, wages are higher when accompanied by training, as one would expect if training is complementary to the practice and benefits from being bundled with it.

Each of the contrasts in the table was tested for statistical significance and the results are shown in Table 3.

If high performance work practices raise wages one would expect most values in the table to be positive and significant, especially in the first and fourth columns. Likewise, if there is complementarity between practices and training, one would expect a significant positive wage difference between those cases where both are present and those where only the practice is present. Surprisingly, on the establishment side, almost all cases where there is a significant difference indicate that establishments with both training and high performance practices pay lower wages than those with neither. In large part these findings seem to be driven by the fact that when training is added to the baseline model without practices or the interaction term, the effect is negative and significant at the .10 level. It is not clear what might explain this unusual result, since, in results not shown here, we found that the presence of any kind of formal training was associated with higher establishment wages.

By contrast, on the employee side, the presence of both a practice and training is associated with significantly higher wages, in the range of 8.5-13% for half the practices. However, casting doubt on whether the gain is coming from the practice, only in the case of quality circles do individuals in establishments with the practice and receiving training have significantly higher wages than those just receiving the training (Column 5). In addition, in only two cases does training seem to provide a boost to wages over and above the effects of the practices alone (Column 6). In short, individuals who worked in establishments with high performance practices and personally received training appropriate for such practices often received higher wages than those not exposed to either, but rarely received more than those exposed to either the practice or the training. This may reflect some degree of multicollinearity between training and work practices, which may result in their combined impact being difficult to distinguish from the impact of either individually (OECD, 1999).

The reasons for interacting practices with the training variable were both to identify establishments more likely to be deeply committed to high performance principles and individuals more likely to be covered by the practice, one the one hand, and to test the idea that the practices are most effective in certain combinations. Other variables can also be used to test whether there are specific complementarities among practices which raise wages beyond their levels when the practices are present in isolation. The remainder of this section uses interaction specifications to examine whether the presence of profit sharing, pay for skill, and unions in combination with other high performance practices are associated with higher wages than when the practices are present on their own.

It is easy to see why profit sharing and pay for skill might be considered necessary for the success of any high performance system. Advocates of high performance work systems have long argued that for fairness and morale

reasons employers had to share productivity gains from such programs with workers, without whose cooperation they were unlikely to yield much benefit (Walton 1985). Similarly, Neoclassical economic theory would predict that without incentives workers will not be motivated to acquire more skills or put forth the extra effort that problem solving and other participative activities require. These considerations argue for interacting the presence of profit sharing and pay for skill practices with the others, rather than simply entering them singly and additively.

Tables 4 and 5 present the results of these interaction models in the same format as Table 3.

The first column of Table 4 indicates that establishments with profit sharing, one the one hand, and peer review, employee involvement in equipment purchases, or TQM, on the other hand, pay higher wages than establishments without either profit sharing or the practice in question. However, peer review is significant by itself in Table 2 and Column 3 indicates that the combination provides no greater wage payoff than peer review by itself, suggesting that it is the effect of the practice alone not the bundling with profit sharing that is significant in these results. Column 2 suggests that the addition of most practices does not raise establishment wages above the level associated with profit sharing alone, except in the case of peer review, which is the only variable other than profit sharing associated with higher establishment wages in Table 2. In the case of three practices, wages are actually lower when they supplement profit sharing plans. Column 3 suggests that profit sharing boosts wages in establishments with certain, though not all, of the innovative practices also in place (job rotation, teams, TQM, and JIT).

On the employee side, the fourth column indicates that the combination of profit sharing and each of four practices is associated with higher wages than when neither is present, but only in the case of peer review is there overlap with the establishment-level results. The fifth column indicates that the combination of profit sharing and a high performance work practice is associated with higher wages than profit sharing alone only in the cases of quality circles, the only practice associated with higher wages in employee-level models in Table 2, and peer review. From the sixth column one sees that only in the case of JIT is the combination associated with higher pay than the practice alone.

Table 5 repeats these analyses but interacts high performance practices with pay for skill rather than profit sharing. Only in the case of peer review are there consistently significant and positive effects. These results are surprising, since à priori pay for skill would appear to be most complementary with job rotation, job redesign, or teams, all of which explicitly involve workers in learning new skills directly related to their job. This casts further doubt on a causal interpretation of the positive effect of peer review on wages. For the practices noted above for which complementarity with pay for skill would be expected, in no case is the combination of these practices with pay for skill is associated with higher wages and it is associated with lower wages in some of the contrasts on the establishment side.

In addition, on the establishment side, Column 3 indicates that the presence of pay for skill and quality circles in combination is associated with higher wages than when quality circles are found alone but there is no significant difference when neither are present (Column 1). However, the figures on the employee side indicate that workers in establishments with both pay for skill and quality circles receive higher pay than workers in establishments with neither or with only pay for skill, suggesting that it is the presence of quality circles which makes the difference. Column 5 suggests that employee involvement in equipment purchases and TQM also seem to be cases in which the combination with pay for skill makes a difference.

Finally, one might well argue that even if there are significant productivity gains, workers must have the power to compel management to share the benefits to see any improvement in their wages. We test whether greater worker bargaining power, as measured by the presence of a union, is associated with greater wage benefits to high performance work practices. Table 6 presents the results of these analyses. As is well known, unions clearly make a difference in workers' wages. Among establishments, those with both a union and a practice tend to pay more than those with neither or with only the practice present. But workplaces with a practice and a union present have higher wages than those with just a union only in the cases of job redesign and employee involvement in equipment decisions, on the establishment side, and quality circles and TQM, on the employee side (Columns 2 and 4).

In sum, our experiments with interaction variables do not provide consistent support for the hypothesis that higher wage are more common when there is greater commitment to a practice or when supporting human resource management practices are in place. That is, in addition to assessing whether a practice is associated with higher wages by itself, we have examined whether the presence of complementary practices (e.g., training and incentive compensation) or an increase in worker bargaining power (presence of a union) make a wage payoff more probable. This reinforces our earlier conclusion that there is little support for the notion that high performance practices are consistently associated with higher wages. As shown in Table 2, only peer review and profit sharing were associated with higher wages for both samples on the establishment side and only quality circles on the employee side. The lack of consistency between the employer and employee side casts doubt on the robustness of these results, as does, in the case of peer review, the improbability that the associations noted reflects a causal relationship. Results from

interactions models do little to strengthen the case for clear wage benefits from high performance work practices.

CONCLUSION

Using a unique data set providing information on establishments and their workers, we have conducted a series of tests to see if the presence of high performance work practices is associated with higher wages, both at the establishment and employee levels. Somewhat surprisingly in light of the literature showing that the reorganization of work has tended to have positive effects on firm performance, we find that the practices we consider do not tend to have detectable effects on the wages of workers, whether we look at all occupations or restrict attention to those thought most affected by the practices. Where we do find positive effects, there are reasons to doubt the robustness of the results.

There are two broad reasons that may explain this failure to find consistent wage payoffs to high performance work practices. Either significant wage effects do not exist or limitations in the data prevent us from uncovering them.

There are reasons to believe that significant wage effects do not exist. Most, though not all, studies which find that innovative practices improve firm performance are based on unrepresentative samples and have problems controlling for non-random factors that affect adoption, so any gains they observe may not generalize to the economy as a whole (Becker and Huselid 1998; Ichniowski *et al* 1996; Kling 1995). Most studies do not attempt to measure the magnitude of increases in skill and responsibilities that result from implementing high performance work practices and some studies suggest that the gains in many establishments are slight (Bailey and Bernhardt 1997). Indeed, there are few studies which explicitly consider, even informally, whether a significant wage impact would be expected from the size of the changes in job task content observed. Further, even if the changes and associated productivity gains are indeed substantial, in an age of reduced worker power they may accrue to profits, rather than being shared with employees.

However, the data also has limitations. Sources of measurement error that might bias coefficients toward zero include the lack of information on the percentage of employees within establishments covered by the various practices, the absence of data on whether employees responding to the survey are personally covered by the practices, and, for establishment-level models, the difference in time between measurement of practices and establishment-level wages.

In addition, differences in overall incidence rates between SEPT95 and surveys such as Osterman (1994) raise the possibility that these practices are intrinsically difficult to measure. Some practices may exist mostly on paper and survey respondents may have different ideas as to what qualifies as a "team" or "job rotation" (cf. Hackman and Wageman 1995). It is possible that deep workplace reforms do improve workers' wages but the effects are washed out when coarse measures group them with more nominal programs. If this is the case, then it is also likely that the descriptive statistics in Table 1 and surveys such as Osterman (1994) significantly overestimate the incidence of serious workplace reforms. In other words, one may still believe that "true" high performance work practices affect wages, but this also implies that there are fewer true adopters at present than existing survey measures suggest.

SEPT95 also contains no information on the conditions that led to adoption nor does the literature provide reliable guidance on this issue. Clearly, we do not know if the implementation of high performance practices is randomly distributed with respect to omitted variables that might affect wages and our inability to control for the reasons for adoption could bias coefficients in either direction. For example, some organizations may adopt innovative work practices because they can afford both to experiment with worker-friendly initiatives and pay higher wages, while others may adopt high performance practices in response to long-term business declines which are associated with payment of below-average wages. In these cases, cross-sectional wage differences may reflect preexisting wage differentials as well as any effects of high performance practices per se. An instrumental variable that influences choices regarding workplace practices but does not otherwise affect wages would correct for this problem, but it is difficult to think of variables that would satisfy these conditions.

Finally, increased pay may be absorbed by shifts in the observed skill composition of the workforce, rather than manifested in higher pay holding skill levels constant. If the practices raise wages indirectly by increasing the demand for more educated workers or more skilled occupations, then our models understate the impact of practices by attributing their wage effects to those variables, rather than to the practices themselves. One way to test for this possibility is to remove controls for occupation and education from the models estimated in Table 2. For the establishment-level models, TQM and employee involvement in purchase decisions are now significant and positive and job rotation is significant and negative. For the employee-level models, peer review and teams are now positive and significant. All the other relationships remained relatively unchanged (results not shown). We do not believe these differences are strong enough to alter our conclusions substantively.

Indeed, it is important to realize that this exercise assumes that any wage effects of high performance work practices beyond those present in Table 2 operate through selection mechanisms. To the extent that these effects

reflect differential selection into employment in high performance workplaces, none of them can be taken to imply that the extension of high performance practices to the rest of the work force would raise other workers' wages by a similar amount. In this case the models in Table 2 are more appropriate.

In sum, the results we present above should not be taken as the final word on the wage effects of high performance work practices. Indeed, given the limited research on this important question, additional research is essential. The limitations we describe point to issues which future studies must address if greater certainty in this area is to be gained. Nevertheless, our findings from one of the few nationally representative data sets with a wide variety of measures of high performance work practices suggests few consistent effects on wages. High performance work practices may hold many benefits for workers in the form of greater dignity at work and more intrinsically interesting job tasks, but our research does not suggest that such practices are likely to significantly reverse the growth of wage inequality as many advocates of "high road" employment systems hope.

REFERENCES

Akerlof, George A. 1982. "Labor Contracts as Partial Gift Exchange." Quarterly Journal of Economics. 97:543-69

Appelbaum, Eileen and Rosemary Batt. 1994. The New American Workplace. Ithaca, N.Y.: ILR Press.

Bailey, Thomas. 1993. "Discretionary Effort and the Organization of Work: Employee Participation and Work Reform Since Hawthorne." Unpublished, Teachers College and Conservation of Human Resources, Columbia University.

Bailey, Thomas R. and Annette D. Bernhardt. 1997. "In Search of the High Road in a Low-Wage Industry." Politics and Society. 25:179-201.

Becker, Brian E. and Mark A. Huselid. 1998. "High Performance Work Systems and Firm Performance: A Synthesis of Research and Managerial Implications." Research in Personnel and Human Resources Management 16:53-101.

Bluestone, Barry and Irving Bluestone. 1992. Negotiating the Future : A Labor Perspective on American Business. New York: BasicBooks.

Burawoy, Michael. 1979. Manufacturing Consent: Changes in the Labor Process Under Monopoly Capitalism. Chicago: University of Chicago Press.

Cappelli, Peter. 1996. "Technology and Skill Requirements: Implications for Establishment Wage Structures." New England Economic Review. May/June:138-154.

Cappelli, Peter. 1998. "Technology, Work Organization and the Structure of Wages." Unpublished, The Wharton School, revised.

Cappelli, Peter and Nikolai Rogovsky. 1994. "New Work Systems and Skill Requirements." International Labour Review. 133(2):205-220.

Florida, Richard and Martin Kenney. 1991. "Transplanted Organizations: The Transfer of Japanese Industrial Organization to the U.S." American Sociological Review. 56:381-398.

Frazis, Harley, Maury Gittleman, and Mary Joyce. 1999. "Correlates Of Training: An Analysis Using Both Employer And Employee Characteristics." Unpublished, Bureau of Labor Statistics, March.

Freeman, Richard B. and James L. Medoff. 1984. What Do Unions Do? New York: Basic Books.

Freeman, Richard and Joel Rogers. 1994. "Worker Representation and Participation Survey: First Report of Findings." Ms.

Gittleman, Maury, Michael Horrigan and Mary Joyce. 1998. "'Flexible' Workplace Practices: Evidence from a Nationally Representative Survey." Industrial and Labor Relations Review. 52(1):99-115.

Gittleman, Maury and David R. Howell. 1995. "Changes in the Structure and Quality of Jobs in the United States: Effects by Race and Gender, 1973-1990." Industrial and Labor Relations Review. 48:420-440.

Gottschalk, Peter and Timothy M. Smeeding. 1997. "Cross-National Comparisons of Earnings and Income Inequality." Journal of Economic Literature. 35:633-687.

Graham, Laurie. 1993. "Inside a Japanese Transplant: A Critical Perspective," Work and Occupations. 20:147-173.

Hackman, J. Richard and Ruth Wageman. 1995. "Total Quality Management: Empirical, Conceptual, and Practical Issues." Administrative Science Quarterly. 40:309-342.

Harrison, Bennett and Barry Bluestone. 1988. The Great U-turn: Corporate Restructuring and the Polarizing of America. New York: Basic Books.

Hunter and Lafkas 1999. "Firm Evidence of the Informating Age? Information Technology, Work Practices, and Wages." Ms., Wharton School, University of Pennsylvania.

Ichniowski, Casey, Thomas A. Kochan, David Levine and George Strauss. 1996. "What Works at Work: Overview and Assessment." Industrial Relations 35(3):299-333.

Ichniowski, Casey, Kathryn Shaw and Giovanna Prennushi. 1997. "The Effects of Human Resource Management Practices on Productivity: A Study of Steel Finishing Lines." American Economic Review 87(3):291-313.

Katz, Lawrence F. and David H. Autor. 1999. "Changes in the Wage Structure and Earnings Inequality." Forthcoming in Orley Ashenfelter and David Card, eds., Handbook of Labor Economics (Amsterdam, North-Holland).

Kling, Jeffrey. 1995. "High Performance Work Systems and Firm Performance." Monthly Labor Review 188(5):29-36.

Kruse, Douglas L. 1992. "Profit Sharing and Productivity: Microeconomic Evidence from the United States." The Economic Journal 102:24-36.

Loveman, Gary W. and Chris Tilly. 1988. "Good Jobs or Bad Jobs: What Does the Evidence Say?" New England Economic Review. January/February:46-65.

MacDuffie, John Paul. 1995. "Human Resource Bundles and Manufacturing Performance: Organizational Logic and Flexible Production Systems in the World Auto Industry." Industrial and Labor Relations Review. 48(2):197-221.

Murnane, Richard J. and Frank Levy. 1996. Teaching the New Basic Skills. New York: Free Press.

National Center on Education and the Economy. 1990. America's Choice: High Skills or Low Wages!

OECD. 1999. Employment Outlook. Paris, June.

Osterman, Paul. 1994. "How Common is Workplace Transformation and Who Adopts It?" Industrial and Labor Relations Review 47:173-188.

Osterman, Paul. 1998. "Work Reorganization in an Era of Restructuring: Trends in Diffusion and Impacts on Employee Welfare." Unpublished, Sloan School, MIT, November.

Piore, Michael. 1989. "Corporate Reform in American Manufacturing and the Challenge to Economic Theory." Manuscript.

Princeton Survey Research Associates. 1994. "Worker Representation and Participation Survey: Report of the Findings." Prepared for Richard B. Freeman and Joel Rogers. Princeton, N.J.

Walton, Richard. 1985. "From Control to Commitment in the Workplace." Harvard Business Review. 63 (2):77-84.

Wood, Stephen. forthcoming. "Getting the Measure of the Transformed High Performance Organization." British Journal of Industrial Relations.

Zuboff, Shoshana. 1988. In the Age of The Smart Machine: The Future of Work and Power. New York: Basic Books.

Table 1. Prevalence of Workplace Practices (Weighted Percent), SEPT 1995

PRACTICE	Establishments		Employees	
	All	Production/Service	All	Production/ Serv./Constr.
SKILL, PARTICIPATION				
1. Job rotation	34	40	48	52
2. Job redesign/reengineering	31	31	46	44
3. Quality circles	27	26	40	39
4. Self-directed work teams	20	18	30	24
5. Peer performance review	18	17	22	16
6. EI in equipment purchasing	44	42	55	56
COMPENSATION				
7. Pay for skill	39	44	39	43
8. Profit sharing	37	34	45	45
OTHER MANAGEMENT PRACTICES				
9. Total quality management	44	42	58	55
10. Just-in-time inventories	22	26	30	39
N	1,062	542	1,074	418

Note: For establishments, percentages indicate portion of establishments with a given practice in place. For employees, figures represent the fraction of individuals at an establishment with such a practice. Establishments in column 2 are those with 65 percent of employment or more in the service and production worker categories.

Table 2. Effect of Innovative Work Practices on Wages, SEPT 1995

	Establishments		Employees	
	All	Prod/Serv.	All	Prod/Serv.
SKILLS, PARTICIPATION				
Job rotation	-0.038	-0.072 **	-0.06 **	-0.071
Job redesign	-0.022	0.04	-0.036	-0.085 *
Quality circles	-0.043	0.022	0.084 ***	0.138 ***
Teams	-0.03	0.077 *	0.046	0.06
Peer Review	0.169 ***	0.098 **	0.047	0.051
El in equipment Purchases	0.037	0.047	0.022	-0.071
COMPENSATION				
Pay for Skill	0.019	-0.021	0.003	-0.036
Profit sharing	0.088 ***	0.117 ***	0.026	0.074
OTHER MGT. PRACTICES				
TQM	-0.002	0.003	0.05	0.103 **
JIT	-0.055	0.019	-0.005	-0.081
Number of practices	0.004	0.011	0.006	0.002
PCA Index	0.005	0.027	0.017	0.007
N	1062	542	1074	418

Note: The PCA Index is the standardized value of an additive scale constructed using the loadings from the first principal component of a principal components analysis of all ten practices.

* p< .10 ** p< .05 *** p< .01

Table 3. Interaction Models: Effect of Work Practice and Communication Training relative to Neither, Training Only, and Practice Only

	Establishment sample			Employee sample		
	Neither	Training only	Practice only	Neither	Training only	Practice only
Job rotation	-0.085**	-0.045	-0.065	-0.004	-0.053	0.046
Job redesign	-0.059	0.000	-0.031	0.027	-0.015	0.063
Quality circles	-0.095**	-0.071*	-0.124**	0.132***	0.077*	0.036
Teams	-0.081*	-0.043	-0.111	0.098**	0.051	0.052
Peer review	0.054	0.092*	-0.226	0.084**	0.024	0.011
EI in equipment purchases	-0.025	-0.012	-0.120***	0.088*	0.076	0.084**
Pay for skill	-0.057	-0.067	-0.161***	0.074	0.051	0.098*
Profit sharing	0.022	0.064	-0.104**	0.054	-0.056	-0.020
TQM	-0.056	-0.054	-0.129***	0.085**	-0.043	-0.002
JIT	-0.079	-0.020	-0.007	0.050	-0.008	0.036
Number of practices	0.011	-0.018	-0.064**	0.094**	0.016	0.051

Note: Contrast between sums of coefficients in the final row are evaluated at the mean number of practices for establishments (3) and employees (4).

* p< .10 ** p< .05 *** p< .01

Table 4. Interaction Models: Effect of Work Practice and Profit Sharing relative to Neither, Profit Sharing Only, and Practice Only

	Establishment sample			Employee sample		
	Neither	Profit sharing only	Practice only	Neither	Profit sharing only	Practice only
Job rotation	0.070	0.020	0.159**	-0.035	-0.066	0.019
Job redesign	0.039	-0.086*	0.038	-0.009	-0.031	0.036
Quality circles	0.018	-0.108**	0.047	0.095**	0.074*	0.007
Teams	0.076	0.004	0.164***	0.072*	0.052	0.035
Peer review	0.183***	0.092*	-0.032	0.079**	0.072*	0.070
EI in equipment purchases	0.090**	-0.085*	-0.008	0.046	0.054	0.053
TQM	0.073*	-0.036	0.070*	0.068*	0.036	0.012
JIT	0.056	-0.018	0.137**	0.043	0.049	0.098*
Number of practices	0.089**	-0.035	0.090**	0.037	0.041	0.028

Note: Contrast between sums of coefficients in the final row are evaluated at the mean number of practices for establishments (3) and employees (4).

* p< .10 ** p< .05 *** p< .01

Table 5. Interaction Models: Effect of Work Practice and Pay for Skill relative to Neither, Pay for Skill Only, and Practice Only

	Establishment sample			Employee sample		
	Neither	Pay for skill	Practice only	Neither	Pay for skill	Practice only
Job rotation	-0.023	-0.074*	-0.002	-0.039	-0.027	0.052
Job redesign	-0.022	-0.078*	-0.040	-0.021	-0.000	0.045
Quality circles	0.006	0.013	0.103*	0.085*	0.122**	0.028
Teams	-0.050	-0.102**	-0.087	0.051	0.072	0.029
Peer review	0.214***	0.251***	0.140**	0.078*	0.108**	0.095*
EI in equipment purchases	0.050	0.079**	0.048	0.021	0.102**	0.045
TQM	0.007	-0.046	-0.016	0.041	0.117**	0.027
JIT	-0.074	-0.137***	-0.088	0.016	0.042	0.068
Number of practices	0.023	-0.020	0.019	-0.019	0.114***	0.006

Note: Contrast between sums of coefficients in the final row are evaluated at the mean number of practices for establishments (3) and employees (4).

* p< .10 ** p< .05 *** p< .01

Table 6. Interaction Models: Effect of Work Practice and Union relative to Neither, Union Only, and Practice Only

	Establishment sample			Employee sample		
	Neither	Union only	Practice only	Neither	Union only	Practice only
Job rotation	0.110*	-0.036	0.149**	0.026	-0.060	0.057
Job redesign	0.205***	0.129*	0.268***	0.039	-0.080	0.057
Quality circles	0.123*	-0.022	0.171**	0.176***	0.128**	0.144***
Teams	0.148*	0.006	0.187**	0.113**	0.027	0.058
Peer review	0.209***	0.039	0.005	0.121**	0.043	0.072
EI in equipment purchases	0.213***	0.114*	0.196***	0.083*	-0.055	0.037
Pay for skill	0.157**	-0.006	0.132**	0.061	-0.047	0.038
Profit sharing	0.233**	0.081	0.143***	0.117**	0.067	0.106**
TQM	0.131*	-0.046	0.122**	0.026	0.113**	0.068
JIT	0.119**	-0.024	0.185***	0.081	0.008	0.094
Number of practices	0.157***	0.024	0.148***	0.107**	0.015	0.077*

Note: Contrast between sums of coefficients in the final row are evaluated at the mean number of practices for establishments (3) and employees (4).

* p< .10 ** p< .05 *** p< .01

Appendix. Effects of control variables on Ln(wages)

	Establishment-level	Employee-level
Female		-0.160***
Age		0.044***
Age^2		-0.0005***
Employee tenure		0.019***
$(Employee\ tenure)^2$		-0.0002
High school graduate		0.112**
Some college		0.220***
Bachelor's degree		0.332***
Graduate degree		0.430***
Hispanic		-0.222***
African American		-0.133**
Part-time		-0.084
Proportion part-time	-0.841***	
Union	0.151***	0.080**
100-499 employees	0.148***	0.022
500-999 employees	0.207**	0.188***
1000+ employees	0.343**	0.181***
R^2	0.569	0.627
N	1,062	1,074

Note: Dependent variables are log average establishment wage and log personal hourly wage. Weights are used for both models. Employee model uses robust standard errors to account for possible clustering of respondents within establishments. Both regressions control for industry and regions. In addition, the establishment model controls for occupational composition of employment and the employee model controls for individual's own occupation. Omitted categories are less than high school graduate, white, and less than 100 employees.

* p< .10 ** p< .05 *** p< .01